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CONTRIBUTIONS TO THE PHYSICAL GEOGRAPHY OF BRITISH EAST AFRICA.*

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I. Introduction.

In an examination of a map of Africa, one of the first points likely to be noticed is the number and size of its great lakes, the exploration of which has been the greatest stimulus to African travel since the discovery of the sources of the Nile and the course of the Congo. Anything beyond a most casual examination of the map shows that the lakes are all grouped in the eastern tropical region, and that they are here developed in two forms. There are those, such as the Nyanza and lake Moero, which are round in shape and have low shores, and those which are long and narrow in shape and have high precipitous shores, such as Tanganyika, Nyasa, and Basso Narok (Lake Rudolf). Further examination, moreover, shows that the lakes are not distributed haphazard, but on a certain definite plan. The long ones are arranged in two lines, which pass one on either side of the Nyanza and meet at the north end of Basso Narok; thence a line of lake-dotted low land, in places below the level of the sea, runs up to the Red Sea. But the Red Sea itself presents exactly the same type of structure; it is long and narrow, and, excluding some strips of coast deposits, has similarly high, steep shores. From its northern end the Gulf of Akaba leads to another valley, margined by deep high walls, and travelling along it we come to another lake situated in a deep depression, and a river in a long narrow valley. These are the Dead Sea and Jordan valley, which continue the

* Paper partly read at the Royal Geographical Society, January 15, 1894. Map, p. 384.

type of structure of the East African lake chain, till it ends off in the deserts of Northern Syria.

From Lebanon, then, almost to the Cape there runs a deep and comparatively narrow valley, margined by almost vertical sides, and occupied either by the sea, by salt steppes and old lake basins, and by a series of over twenty lakes, of which only one has an outlet to the sea. This is a condition of things absolutely unlike anything else on the surface of the earth. It is, therefore, only natural to inquire whether this great valley consists merely of a series of independent basins formed by depression or erosion, the linear arrangement of which is but an accident, or whether it is all due to a common cause, which formed a great earth crack or depression at some comparatively recent period of the earth's history. All along this valley the natives have legends of great changes in the structure of the country. The Arabs tell us that the Red Sea is simply water that did not dry up after Noah's deluge; the Somalis say that when their ancestors crossed from Arabia to Africa there was a land connection across the straits of Babel-Mandeb. The natives of Ujiji have a folk-lore that goes back to the time when the lake of Tanganyika was not; while in the extreme north, there are the better, or rather more widely known, but less definite legends of the destruction of Sodom and Gomorrah.

It may be objected that if a valley such as the one suggested could have been thus formed, why are there no others of a corresponding size and arrangement? Many such valleys are known in America, where, *e.g.*, the Yosemite can only be explained as due to the subsidence of the orographic block that formed the floor of the valley. These cases, however, are much shorter. The nearest approach in size can probably be found on the moon, whose clefts or rills no doubt represent long steeply walled valleys, and present to us much the same aspect as this East African valley would do to any inhabitants in our satellite. Not the least interesting of the points raised by the African-Red-sea-Jordan depression, is the possibility that it may explain the nature of those lunar clefts which have so long been a puzzle to astronomers.

Though the main features in the geography of most of this line of depression is now fairly well known, our information as to the geology of the African part is extremely limited, and is based mainly on the study of odd pebbles and fragments brought home by travellers. When, therefore, the offer was made to me to accompany as geologist an expedition across the Borana-Galla country to Basso Narok, and north across Somaliland to Berbera, I was naturally eager to accept it. On the kind recommendation of Sir William Flower and Dr. Woodward, the trustees of the British Museum generously granted me the necessary leave of absence.

This expedition, however, unfortunately collapsed three marches from the coast. I was extremely reluctant to return to England

without having done something to repay for the wasted time, and I resolved to make a second effort to reach the line for the study of which I had gone to Africa. Too much of my ten and a half months' leave of absence had been spent on the Tana for it still to be possible to reach Basso Narok; moreover, the small force which my limited resources would allow me to employ would have been quite inadequate for the traverse of the country of the Wasuk. I resolved, therefore, to attempt to reach the highest part of the valley of subsidence between Lakes Naivasha and Baringo, as the maps suggested that the geological structure of this valley might be worked out even better there, than on the shores of the great northern lake—Basso Narok. In this opinion I was strengthened by a letter from Professor E. Suess.

As I could not wait for any instruments to be sent out, even from Bombay, I was compelled to start with a most inadequate geographical equipment; this consisted only of a prismatic compass, an Abney level, a Watkin's clinometer, an aneroid graduated only to 21 inches, and two boiling-point thermometers. For the last I have to thank my friend Mr. Bennett Stanford. I was, however, encouraged to persevere by the consideration that I could, after my return, use the maps of the Railway Survey as a base, and work from these by dead reckoning, accepting Von Höhnel's determinations of the position of Kenya. This, of course, is not scientific geography, but it seemed better to work on by this rule-of-thumb method rather than abandon geographical exploration altogether.

I should here like to express my thanks to the friends who kindly helped me to organize my caravan or to ease the way. Foremost amongst these are Messrs. W. H. Harris and J. Bennett Stanford, two members of the original expedition. They did everything that men could do to raise it after its collapse; and when they found that I was going on alone, they helped me in every possible way, and gave me a most generous present from the stores of the former expedition. To Mr. J. R. W. Piggott, the Administrator of Mombasa, I am greatly indebted for his kind hospitality during my first stay there, and for much valuable advice and help. To Drs. Macdonald and Mackinnon and Mr. C. W. Hobley I also have to express my best thanks—to the two first for some medical stores and information; and to the last, who, as head of the transport office in Mombasa, gave me much help in fitting out and selecting trade goods. The officers of the British East Africa Company's inland stations at Machakos and Kikuyu, viz. Messrs. Ainsworth, Purkiss, and Hall, also gave me the kindest assistance when passing through the stations in their care. Dr. Charters and Mr. Watson of the Scottish Mission at Kibwezi, and Mr. George Wilson, the engineer of Sir William Mackinnon's road, both helped me most generously with food, when I should otherwise have been unable to procure it. Nor must I forget my headman, Omari ben Hamadi, to

whose pluck and energy and splendid devotion the expedition owes most of whatever success it may have had.

II. The Route and List of Camps.

In the first expedition we landed at Lamu, and crossed from that island to the mainland at Mkonumbi. A night's march to the east, through grass land with baobabs and forests of hyphæne palms, brought us to the historic town of Witu; by another two marches, at first across similar country, and then over the steppes and alluvial plains of the Tana, we reached Ngatana, where seven weeks later the expedition was disbanded. In the return march, Mr. Harris and I descended the right bank of the Tana to Golbanti, and thence to the coast at Marareni, passing on our way the upper marshes of the Khilifi river near Kurawa. Another march took us to Mambrui, and a rest there afforded the opportunity for a visit to the red sandhills of Magarini. Melindi is another short march along the coast, and Mombasa four days to the south of this.

The second expedition left Mombasa on the afternoon of March 23, 1893. It consisted of forty-one members, viz. a headman Omari ben Hamadi, four Askaris, thirty-three porters, a cook, a tent-boy, and myself. Though I was suffering from a severe attack of fever at the time, we started next day on our march for Machakos. We travelled *viâ* Taro, Maungu, Ndara, the Voi route to Ndi, and thence to Tzavo, where the river was in full flood. Crossing this, we made for Kibwezi and Nzaoi, where we entered the Iveti mountains, which we traversed till beyond Machakos. Thence we crossed the Kapte plains and through the forests and shambas of Ukikúyu to Fort Smith at Kabéti. Rising steadily through woody uplands, we struck the edge of the great valley of subsidence—the Graben of Professor Suess—on the summit of the Kikúyu fault scarp. A steep descent of about 800 feet brought us to the floor of the valley by the Guaso (river) Kedong. Continuing northward, we followed the valley or great meridional rift to the ridge that crosses it north of Lake Baringo. We kept close to the east wall, leaving the track at Miviruni, and reaching Baringo by a new route past a small lake, the name of which I find to be Kibibi, and along the east shore of Lake Losuguta (*syn.* L. Hannington).

During the journey numerous branch excursions were made to examine the walls of the Mau escarpment on the west, and the Kikuyu and Laikipia fault scarps on the east.

Leaving Njemps Mdogo on June 6, we started east-south-east on to Laikipia, and, keeping along the western side of this plateau, struck for the great valley, which I expected to find between the mountains called Doenyo Kinangop and Doenyo Goyito and the Aberdare mountains. We crossed the ground whereon Höhnel has placed this range, and entered the north-eastern end of Ukikúyu in the upper part

of the Thagana or Sagana valley. Two days' march from this took us to the west foot of the mountain Kenya, about an hour and a half's walk from Teleki's camp at Ndóro. Our camp there was used as the base of operations on Kenya, till the exhaustion of our food-supply compelled us to return again to Ukikúyu. We traversed this country to the south, till we descended from its rolling uplands on to the lava plains of the Tana, near Maranga. We crossed the Tana—there known as the Kiroróma—just above its confluence with the Thika-Thika, and followed this river over the "Nyika" steppes, and through the gorges of the northern Iveti mountains, on to the plains of the Athi. Crossing both rivers near Chanjavi, we returned to Machakos *viâ* the Kavalúki valley. Thence by the Kapté plains and the hill country of Maká, we reached Nzaoi, and retraced our steps to Tzavo. There we diverged to the east, down the Sabaki valley till below the freed-slave settlement of Makongéni. A last march of four days over the hills of Giriama, through Fuladóya, Mwaiba, and Ribe, took us to Mombasa, where we arrived on Saturday, August 19, having covered 1800 miles in four days less than five months.

The list of camps in the Appendix shows the route more in detail, and will be more convenient of reference to any who may have occasion to refer to the collections made during the expedition, especially as the paper is not written in a narrative form.

III. The Physical Features of the District.

The geographical structure of British East Africa may be represented as composed of seven zones, running roughly north and south, and approximately parallel to one another. These seven zones or belts consist of three mountain ranges and four plains or plateaux.

The first of the mountain systems, both in time and proximity to the coast, is the range which may be regarded as the African "Urgebirge," as it must have formed the primitive axis of the continent, once extending from the Drakensberg of Natal to the Shoho mountains of Abyssinia, and perhaps even to the Ababd mountains of Egypt.

In British and German East Africa this primitive axis of the continent is less perfectly preserved than elsewhere, and it is often buried under vast volcanic piles, such as those of Kenya and Kilima Njaro. The principal representatives of this range consist of the Ugwéno and Paré mountains on the south side of the Anglo-German boundary; of the gneiss mountains of Bura, Taita, and Ongalea,* the numerous "bare hills" of the Railway Survey on the plains of Kikumbuliu and west of the Ndangi river, and of Bwinzau, east of Kibwezi. Further north the line is continued by the gneissose and schistose dome of the Iveti mountains and the gneiss ranges of Ithámba, Voróni,

* The Kyulu mountains of the Railway Survey.

and Changabúbu on the south margin of Eastern Ukikúyu. Here the gneiss hills disappear below the lavas and agglomerates of Ukikúyu and Kenya; but north of this it again appears in the Doenyo lol Deika, the Loróghi mountains, and General Matthew's chain, and passes northward into regions geologically quite unknown. The continual recurrence of steep bare "hogsback" hills of gneiss, and the remarkable persistence in the north and south foliation and characters of the rocks, show that they are part of a common chain. This has, however, been lowered and broken by prolonged denudation, and is now breached by all the larger rivers of this part of the African counterslope. It is the third mountain system to the west that at present forms the main watershed.

The second mountain system is better known from the size of its two most famous peaks, Kilima Njaro and Kenya. As is usual with volcanic cones, the mountains of this series are distributed more sporadically than those of the former, and so are not so important as far as the drainage of the country is concerned. The principal mountains are arranged in a meridional line from Kilima Njaro to Kenya and to Mount Lulall on the east side of Basso Narok (Lake Rudolf). The Theuka and Kyulu* mountains occur along this line between the two first mountains; I was not, however, able to visit them, and thus cannot say whether they belong to the same period of eruption or to a later one along the old line. The latter is not unlikely, as a parallel series of later date runs up the meridional rift. The two principal mountains of this series occur at points where the meridional line is traversed by one at right angles to it; thus on the parallel west of Kenya are Settima and Longonót, and on that through Kibo—the later peak of Kilima Njaro—are Mawénzi and Mount Merú.

It is important to notice that the principal rivers that have their sources on these mountains rise on the western slopes, and flow round their flanks to the east.

The third mountain belt, though the most important in Eastern African geography, does not include any very conspicuous peaks, and is overshadowed in popular estimation by the famous snowclad summits of the volcanic zone. This chain must once have been a great anticlinal or arch, extending from the Nyasa on the south to the Afar region of Abyssinia on the north; its summit then formed the main waterparting that separated the drainage into the Indian and the Atlantic oceans. A similar anticlinal may have existed further to the west in the Equatorial region; it probably diverged from the more direct one in the neighbourhood of Lake Nyasa, and curving round to the west of the Nyanza, and passing through Tanganyika, Lutan and Mwutan Nzige, reunited with the main axis to the north of Basso Narok. Between

* The Ongalea mountains of the Railway Survey.

these two lines was included the area formerly only of internal drainage, but now opening to the Congo and the Nile. That this third zone is not now recognized as a distinct mountain range is due to the fact that the centre of the arch has fallen in, forming one of those valleys of subsidence with long, steep, parallel walls which Professor Suess has called "Graben." The famous Yosemite valley may be taken as a well-known type of these "rift valleys," as they may conveniently be called.

The tops of the walls of this valley still form the water-parting, the streams on the east slope going to the Indian Ocean, and those on the west to the Congo or the Nile; but between the walls are a series of rivers which flow into lakes which, except in the single case of the Nyasa, have no outlets to the sea.

The four remaining zones are plains and plateaux which constitute the greatest superficial extent of the country. The first and lowest of these is that which is known to the Swahili as the "temborari" or coastal plain which occurs all along the shore between Lamu and Mombasa, except for a narrow strip between the estuaries of the Khilifi and Takaaunga. This coast zone is formed in the main of raised coral rock and cemented coral sand, and is covered by sand-dunes, raised beaches, and a red soil of wind-borne quartzose sand. This tract of country is generally extremely fertile and well cultivated, and is the great fruit-growing district; it supports dense groves of palms, orchards of mangoes, oranges, and limes, and extensive shambas of pineapples, cotton, and coffee. It is from these that the leading Arabs of the coast have in the past derived their wealth.

The width of the temborari varies considerably. At Mombasa it is only about two miles wide; at Takaaungu it is completely cut out by the red sandhills, which here slope steeply to the sea; at Melindi it has widened considerably, and from there to Lamu averages about 10 miles across. It is deeply indented along the coast by sinuous estuaries which branch repeatedly; the creeks thus formed often unite with those of the next estuary, and thus islands are cut off from the mainland. Thus have been formed the island of Mombasa and the Lamu Archipelago.

The passage from the temborari to the high inland plateau is in places well marked, but at other times it is somewhat indefinite, as a series of foothills leads gradually from one to the other. The former is well seen north of Freretown, where there is a single steep slope from the low coastal plain to the plateau of Ribe at the level of over 800 feet. The second condition is typically found west of Mombasa, where there is a slight rise from the Makupe ferry to the shambas of Chamgámwe at the height of 200 feet. Beyond this lies a well-watered undulating upland covered with shambas, with numerous groves of palms and plantains, large mango orchards, and extensive fields of dry rice, maize, and mtama (dhurra). The country is formed of Jurassic shales and sandstones,

with some beds of limestones, and with these are associated thick masses of red sands and sandstones.

In other districts the soft Jurassic beds have been either entirely removed or left only as a series of low rounded hills, such as the three to the north of Freretown, which are known as "Ngoa Mombasa" (Kiswahili), or "Coroa Mombasa" (Portuguese). To the west of these is a low estuarine plain, from which rises the steep slope of the great inland plateau. Further north the Jurassic beds have disappeared entirely, as the hills of the red sand and Carboniferous sandstone series reach the sea, and the temborari rises gradually into the higher plateau.

The Nyika, the second plateau, is in striking contrast to the lower or foot plateau both in character and extent. It is bounded on the east by the edge of a steep escarpment, the summit of which is usually at the height of about 800 feet; thence it extends to the west as the vast barren sandy steppes which separate the mountains from the sea. The soil is red and quartzose, water is scarce except in the rainy season, and the vegetation consists in the main of loose mimosa scrub. With the exception of occasional oases and a narrow tract on either side of the rivers that traverse it, the whole country is uninhabited. As some distinctive name is needed for this belt of country, the name "Nyika" has gradually come into use.*

As far as British East Africa is concerned, the Nyika extends throughout the whole country from north to south, being broken only by a narrow belt on either side of the Tana and Sabaki. Its main western limit is at the foot of the gneiss hills of the primitive mountain axis; but in places where this has been broken through, or where it is only represented by isolated bosses such as Bwinzáu, the Nyika extends further west to the fertile plains of the next zone, or to the base of the mountains of the volcanic chain.

West of the Nyika, and generally separated from it by the primitive mountain axis, are the first of the series of high plateaux which form the great grazing lands of the interior, and for which the Masai name of Rangatan may be generally applied. The most important of these is that known as the "Kapte" plains, which stretched northward from Kilima Njaro between the Ongalea, Kyulu, and Iveti mountains to the east, and the mountains of Matumbato, Massimani, Ngongo Bagas, and Kikuyu on the west. It thus includes the plains that border the upper

* As the country is a distinctive geographical type, it certainly seems best to adopt some native name analogous to "prairie" or "tundra." "Nyika," or "Unyika," really means the country of the Wanyika, but the Rev. W. E. Taylor uses it in his Ki-Giriama Vocabulary for "desert," which is probably a Swahili use of the word. "Nuka" in Ki-Chagga is applied to the same tract of country, but Mr. Taylor informs me that it there means "lifted up," and perhaps was given to it owing to its elevation, and Nyika may have originally meant the same. "Puri" might be more correctly adopted, as both the Wanyamwesi and Swahili use it for a scrubby plain, while the Ki-Giriama "weru" might do, as it means "steppe" rather than mere desert.

Athi, and runs eastward along the Thikathika, interrupted only by a few miles of sandy Nyika, till it crosses the Kiroruma and ends at the hill land of East Ukikúyu. Due north of this, and separated from it by the comparatively narrow stretch of Ukikúyu, is the high plateau of Laikipia; this stretches northward from Ukikúyu between Kenya and the Doenyo lol Deika on the east, and Settima and the edge of the fault-scarp of the great rift-valley on the west.

A third Rangatan occurs to the west of the rift-valley, and slopes slowly down to the basin of the Nyanza. It is known, from the colour of its soil, as Rangatan Nyuki, or the "Red Plain;" it is traversed by the Guaso Nyuki.

These Rangatan resemble one another closely in their general scenery, which is in striking contrast to that of the Nyuki, for their lava soil is extremely rich; they retain moisture well, and are in consequence covered with rich long grass, which, as it ripens, turns a light golden yellow, and from its vast extent reminds one of the great corn-clad prairies of Dakota. When the grass is low and green, the springy turf and well-rounded undulations, and steep, narrow, and often dry valleys give the country the aspect of our chalk-down scenery. It is on these plains that, if the experiment of European colonization be attempted, the best sites for the first settlements may be found.

The last of the eight zones is the most remarkable of them all, consisting as it does of the floor of the great valley of subsidence which runs from Nyasa to Afar, and which in British East Africa extends from the German frontier on Lake Natron to north of Basso Narok. The valley usually has a flat, level floor, bounded on either side by the escarpments, or more correctly the fault-scarps, of Mau, Kamasia, and Karamoyo on the west, and those of Ngongo Bagas, Kikuyu, Kinangop, Laikipia, and Samburu on the east. The description of this rift-valley, with its lines of but recently extinct volcanoes, its lakes and rivers, and the scarps of its innumerable faults, will be given in Section VIII.

The following diagrammatic section will show in brief the structure of the country, on an east and west traverse from the coastal "temborari," over the foot plateau, Nyika, the primitive mountain axis, the volcanic chain, and the Rangatan zone to the rift-valley and its fault-scarp walls:—

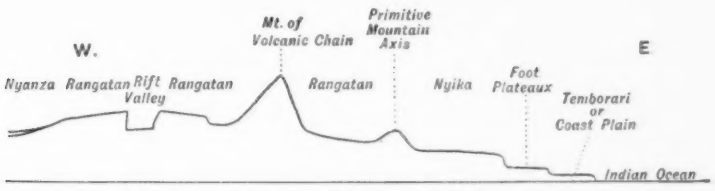

FIG. 1.

IV. The Coast Zone and the "Broads" of the Tana.

Since the journeys of Von der Decken, Wakefield, and New, our knowledge of the coast zone has, in spite of its accessibility, been allowed to lag, except for the actual course of the Tana and the neighbourhood of the chief ports. Lieutenant Smith has, however, given a good account of the country south of Mombasa, in a recent memoir. A series of excursions over the estuarine plains of the Tana and Ozi, as well as the marches from Mkonumbi to Ngatana, and thence to Melindi, gave me opportunities for an examination of a good deal of the country. This may be divided into four types: (1) the actual coast deposits; (2) the river valleys; (3) the more open sandy "barra;" and (4) the hills of the "red sand series." The country as a rule is low, but the dunes are often high, reaching the height of 250 feet on Lamu Island, while they are also very conspicuous near the German cotton plantations at Ras Chagga, near Kipini, and north of the mouth of the Khilifi river, near Kurawa. The red sandhills also often attain a considerable elevation, and are about 400 feet near Magarini. The soil is often very rich, though there is a great deal of barren sandy ground. The low alluvial plains near the mouth of the Tana are especially fertile, and are flooded twice a year; they are, however, extremely unhealthy. Raised coral rock occur as far inland as Witu.

The descriptions of New and Wakefield give a good idea of the country south of the Tana, and those of Peters of the district opposite the Lamu archipelago, and between that and the Tana. The agricultural capabilities have been described by Mr. W. W. A. Fitzgerald, in a report to the British East African Company.

The new features noted in the structural geography of the country may be considered in reference to the rivers, lakes, and hills.

The Tana is the principal river, and its course has been described by New, Peters, and Gedge, the last from observations by the officers of the I.B.E.A. Company's Tana expedition. The two points to which I wish here to refer are the changes in the former course of the river and the origin of its lakes. When canoeing down the river, one sees frequent traces of false bedding in the banks, and this is often so arranged as to indicate that the Tana is now cutting across the bed of a former river almost at right angles. In the march from Witu to Ngatana, we thrice crossed a deep, dry "nullah," or channel, of approximately the size of that of the Tana, and it was obvious that at no very distant date this river flowed along a very different line to that which it occupies at present. This could have been readily inferred from the character of the country without any such direct evidence, for the whole of the great sheet of river alluvium that spreads out from the Tana must have been deposited during meanderings of the river from one side of the valley to the other. By excursions from our camp at Vuju, in Ngatana,

I was able to find the river-bed at many places, and thus to mark its course approximately on the accompanying map. Before the last great change in the direction of the river, it left its present course at Ngatana, flowed across the barra and through the woods at some distance to the east, and finally entered its present channel a little below Ngao. Both the Wapokomo and the Galla have traditions of the change, as I afterwards found from Herrn Wirth and Beking at Ngao, and the late Mr. Edmunds of Golbanti. The Gallas told the last that the change occurred a little before the time of the oldest living inhabitant of the district, but some of them remembered seeing a little water flowing along the old channel. The river had been the boundary between the Bararetta and Kofira Gallas, and its old channel is still accepted as the line of demarcation.

The changes of direction must be more frequent nearer the mouth of the Tana, as they are there largely aided by the regularity of the wind. This blowing up a reach causes an eddy on the inner side of a sharp bend; sediment is deposited in the dead water above this, and a bar thus formed partially across the stream. The current is therefore directed as from a nozzle on to the opposite bank; this is rapidly eroded, and thus the surrounding country, much of which is below the level of the river, is flooded.

It is necessary to consider these changes in connection with the formation of the Tana lakes, for it is a misconception of their nature that has led many geographers to doubt the mapping of the earlier explorers. The lakes are five in number, while there are innumerable swamps which represent former lakes.

Galla name.	*Pokomo name.*	
Ashaka Babo.		Near Ngao, on right bank of Tana.
Kongalolo.		South of Ashaka Babo.
Musania.		Opposite Ashaka Babo, on left bank of Tana.
Nakalo (*i.e.* "the place of lions").	Somite.	Ditto, north of Musania.
	Dumi.	Near Merifano, south of Ngatana, on right bank.

The only lake of the series which has been previously recorded is Ashaka Babo, and the Tana is generally represented as flowing through it.* New first visited it by the channel just above Negao, which is now in much the same condition as when he canoed up it. It is united to the Tana by a second outlet, which passes through Lake Kongalolo, and joins the Tana at Kaekwa, just above Borabini (Golbanti).

Lake Dumi is the one furthest up the river; it also has an outlet to the river in the rainy season.

* Mr. Hobley has, however, referred to some of them in his recent paper on "People, Places, and Prospects in British East Africa," *Geographical Journal*, Aug. 1894.

Musania and Somite are both rounded in shape, and have no outlet. The origin and character of the Tana lakes can best be explained by comparing them with the well-known Norfolk Broads, which have been formed in precisely the same manner, and present remarkable analogies in scenery, shape, and position. In a paper upon "The Physical Features of the Norfolk Broads," * I pointed out that these were due to the formation of a bar across the mouth of an estuary that once covered the site of the town of Yarmouth. The bar was formed by sand being drifted southward by the tide; sediment was deposited by the river inside the bar, and thus helped to complete it, and further to divert the river to the south. The silting thus commenced worked backwards up the estuary, while the growth of rushes and the accumulation of the sediment caught by them, caused a bank of alluvium (known in Norfolk as the "rand") to grow inwards from the margins of the valley. The rivers deposited their burdens of mud and silt where they entered the estuary, and thus built embankments out into it. Thus while the formation of the bar converted the estuary into a lake, this was cut up into a series of smaller ones, by the alluvial embankments. By the enlargement of these, a great alluvial plain was produced, with a river winding through it, and bordered by a series of lakes which are sometimes completely isolated from the river. Thus, in the case of the Norfolk Broads, there are some, such as Fritton, which are completely cut off from the present watercourse; others, such as Wroxham Broad, which are close to a river, and open into it by one or more channels; and others, such as the group of the Rollesby, Ormesby, and Filby Broads, which occupy branch valleys, and are connected with the main stream only by a very narrow overgrown channel.

The Tana "broads" have been formed in precisely the same way. Under the influence of the north-east monsoons, sand has drifted southward along the coast, barred the original mouth, and compelled the river, after it has reached 400 yards from the sea, to flow parallel to it for over 8 miles before it reaches it. The whole estuary has therefore been silted up except the narrow river-channel and a few lakes left as remnants of the great sheet of water that once covered the area. The Tana broads may, moreover, be classed into the same three types as those of Norfolk: thus Kongalolo and Dumi represent those which are situated on the alluvial plain, but are still connected with the river; Somite and Musania, those that are completely isolated; while Ashaka Babo, in its hollow in the "red sandhills," represents those in lateral branches of the main valley.

Ashaka Babo doubtless once had a greater extension to the north, and very likely was once continuous with Musania, which is now on the opposite side of the river. The Wapokomo have a tradition to this

* *Nat. Sci.*, vol. i. 1892, pp. 347-355.

effect, which was told me by Herr Wirth of the Mission Station at Ngao. If so, the two lakes would have been separated in the same way as Wroxham Broad was once cut off from Hoveton Broad by the Bure, which flows between.

The easternmost point reached by the Tana is at Charra, and less than two miles from this is the smaller but still considerable river of the Ozi. The two are connected by a narrow, artificial channel called the Belezoni Canal. At the point where this enters the Ozi the river turns eastward, which is its main direction as far as the old settlement of Kau. Here the Magagoni enters it from the north, and the two flow to the south-east. They are soon joined by the Kirimanda, which rises near Witu, and the three expand into a broad estuary, at the mouth of which is the port of Kipini.

The estuary is so large that it is not surprising that a long course has been generally assigned to the Ozi, and in the older maps it appears as a more important river than the Tana. A native, however, gave New some information which, if it had been believed or noticed, would have shown the course of the Ozi to be very short. I believe the river rises in an enormous swamp, which extends from opposite Golbanti to north of Ngao, on the left bank of the Tana. I involuntarily explored this, and in the middle found a channel flowing to the south, away from the Tana, and toward the Ozi. If so, then the river is limited—exclusive of its windings—to a length of 10 miles above the entrance to the Belezoni Canal. Had it been any longer, I must have crossed it on a march from Witu to Ngao, during which I kept well to the south of the ordinary track. The only thing at all like a river-channel then crossed was a swampy depression that must be the upper part of the Magagoni.

The Khilifi is another river much exaggerated and misrepresented on the maps. It really rises in two swamps, one of which is crossed about two hours north-west of Kurawa, and the other occupies the depression at the foot of the hill on which that well-known camping-ground is situated. The water from these two unite and expand into an enormous swamp, three miles in width. It is separated from the sea by a narrow stretch of sandhills, which turns the river to the south. The real length of the river appears to be only about 10 miles. The Mamareni marked to the south of it has practically no existence.

Most of the coast country is very low, but there is a line of hills near the coast composed of a series of red sands, to which I propose to refer as the Magarini Sands. They form picturesque, rounded, isolated hills as just west of Merifano, undulating uplands as west of Ngao, or a chain as at Magarini. At the last they rise to the level of about 400 feet. In the march along the coastal plain north of Melindi these red sandhills are conspicuous features, but south of it they appear less

important, owing to their proximity to the coast, and the greater elevation of the sandstone hills of Giriama and Shimba.

V. The Giriama Hill-lands.

This is the tract of upland stretching south from the Sabaki to Mombasa. It is bounded to the west by the "Nyika," and to the east by the coastal plain. The general aspect of the country has been well described by New and Wakefield, and more recently by Rev. W. E. Taylor in the admirable introduction to his Giriama Vocabulary.

A line along the western border was mapped by the Railway Survey, but as I crossed its summit, to the east of the Railway route, I was able to collect many new place-names.

VI. The Iveti Mountains.

East of Nzaoi and south of Machakos is a great tract of rolling upland cut up by numerous sinuous and deep ravines. One part of the country is known to the Wakamba as Ulu, a name which has been extended by Von Höhnel, under the name of "Ulu Berge," to the whole group of mountains; the Railway Survey have correctly restricted the term to its proper limit. As both topographically and geologically this group of mountains and ridges forms a definite system, a name for it is wanted. Mr. J. Ainsworth, the superintendent of the Machakos station, whose knowledge of the district is unequalled, and who has prepared a most admirable map of the north-western part, recommends the name of the "Iveti Mountains," after the principal district; as this is the name by which they are known to the Swahili, it is the best that could be found.

The mountains consist of a series of concentric ridges of gneiss round a central area of elevation. This arrangement is now obscured by faulting along the west, and probably also on the south side. If this be borne in mind, the topography becomes fairly simple, though otherwise it would appear very puzzling.

The first principal ridge seen, when approaching from the coast, is that which terminates to the south in the bold gneiss peak of Nzaoi. A few isolated bosses occur outside it, such as the Wakamba watch hill of Thumba. The Nzaoi ridge runs north and south till it is breached by the valley of the Kiti, east of Kilungu. Thence the outer ridges form a series sweeping round to the north-west; those immediately to the north of the Nzaoi ridge are known as Thangu and Wangu, and are represented on the north side of the Machakos river by the ridges of Mala and Kavaluki. The trend there becomes more westerly, and then, bending to the south-west, the hills of Lukenya, Malili, etc., limit the group on this side. The south side I only saw in the distance, and the arrangement may be less simple, but there the ridges seem to form a complete east and west series, continuing the ridge of Methu, near

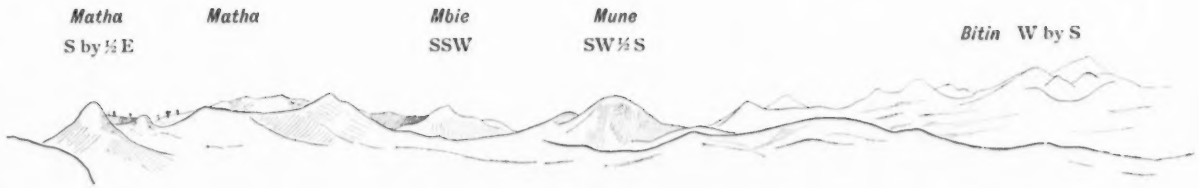

Fig. 2.—S. Iveti Mountains: View to South-west from camp at Nzaoi.

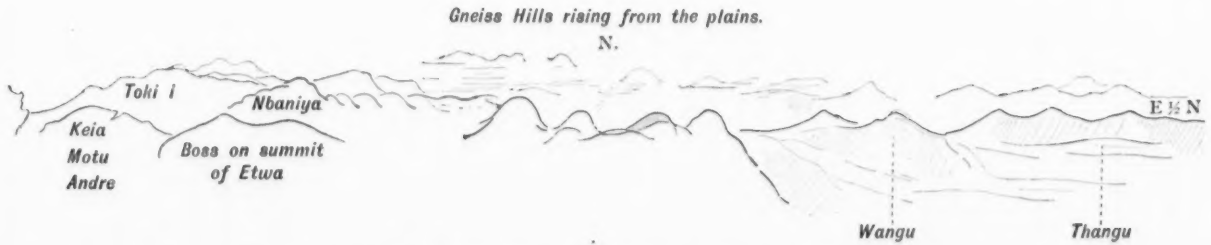

Fig. 3.—View to North from summit of Mt. Etwa near Kilungu.

Nzaoi. The central area is more complex, but the east and west direction of the southern part is seen in the ridges of Meia, Wanue, and Mavu on the right slopes of the Kiti valley. The principal ridges are shown in sketch map (inset map on Map, p. 384).

VII. The Kikúyu Uplands.

The country of the Wa-Kikúyu consists of a long belt stretching from Ngongo Bagas, north-north-eastward to the southern slopes of Kenya; it is about 100 miles long and 30 broad. It appears to be composed entirely of volcanic rocks, though some ridges of gneiss, as, *e.g.*, Changababu, come close up to the southern margin at the eastern end; the soil is therefore very fertile, and was richly wooded. It is densely populated, though on the north side the plantations occur only in clearings in the forests owing to fear of the Masai. On the south side the country is lower, the rainfall less, and the forests are replaced by woody scrub, most of which has been cleared.

The topography of the country is rendered extremely puzzling, as the surface is cut up by the most complex valley system I have ever seen; the origin of this I should have tried to work out had the natives been less unfriendly. It appears to have been due to some such sequence of events as follows. The main slope of the country was determined by the subsidence of the district now covered by the Kapté plains and the lava plains of the upper Tana; as Laikipia remained fixed, this movement gave the whole of Ukikúyu a south-eastern slope. The rainfall being very heavy, the rocks easily denuded, and very variable in hardness, the streams cut a series of deep and sinuous gorges. Another cause of irregularity was that numerous lakes occurred in hollows, and these have now been drained by the basal corrosion of the streams; these all flow into the Tana, either directly or by the Thikathika.

In the return march we crossed the country at almost its widest part, south of Ndoro, and through the previously unvisited districts of Kornu, Kithu-Uri, and Maranga.

VIII. The Rift-Valley.

The desire to study the physical and geological structure of this valley in its highest part was the main incentive to my visit to Naivasha and Baringo, and its topography may be considered in detail owing to its unique character and interest.

The mountains that form the eastern wall of the valley are first seen towards the end of the first march from Machakos. As we cross a broad turf-clad col, and wind down the picturesque valley that leads to the camping-ground of the "first Lanjoro," a line of irregular hills comes into view far on the west horizon. For two days the route lies across the broad undulating prairie of the lava-sheets of the Kapte plains. Two more marches are necessary to cross the woody uplands of Ukikúyu,

and one then rises from the forests on to somewhat bare turf-clad hills. Having attained the summit of these, there is seen to the west a type of scenery quite unlike anything that has been previously seen in Africa, or which can be seen in Europe; it is a type of scenery that can best be paralleled in the Great Basin of Colorado. One is standing on the summit of an almost vertical cliff 800 feet in height, at the foot of which is a perfectly level plain, which appears absolutely barren except for a thin scrub of flat-topped mimosas at the foot of the cliff, and a fringe of large acacias along the course of the Kedong, till that river loses itself in the desert to the south. Rising from the plain in the west can be seen the cliffs of the Mau fault-scarp—or, as it is usually called, escarpment—which corresponds to the Kikúyu fault-scarp. To the north the view is limited by the splendid volcanic crater of Longonót, and the ridge of lava between its base and the east fault-scarp at Kajabe. To the south the rift-valley curves slightly, while the sky-line is partially occupied by the breached crater of Doenyo Suswá. With the exception of the two extinct volcanoes, the whole of the scenery is characterized by straight lines. Instead of the valleys having the sinuous courses due to erosion, they are straight with parallel sides, while the slopes are steep and bare, not yet having been moulded into curves by the slow action of subaerial denudation.

There are in England certain cliffs which are due to faults, but they are scarce and insignificant compared to the fault-scarps of this rift-valley, which in its height and enormous length, and in the general character of the scenery, reminded me of the great fault-scarp of the Wahsatch mountains, which forms the eastern boundary of the basin of the great salt lake of Utah.

In attempting to give a brief sketch of the topography of the highest part of the great valley of subsidence, it will be best perhaps to treat the subject in the following order: (1) the walls of the valley; (2) the floor; (3) the lakes and rivers; (4) the mountains within the valley.

The Walls.—Throughout the part of the valley here considered, the walls are formed by two roughly parallel lines of cliffs. That on the west is known by the general name of the Mau escarpment, or Mau mountains (Mau Kette of Von Höhnel). This extends from Lake Natron on the south side of the Anglo-German frontier, to the west of Eldalat, near Lake Nakuro; here it forks, one branch trending slightly to the east to form the narrow plateau of Kamasia, while the western branch, separated from the other by the narrow valley of the Weiwei, forms the eastern face of Elgeyo.

The eastern margin of the rift-valley is formed by a similar cliff-line; the southernmost section of this is the west face of Ngongo Bagas. This is continued northward by the part called by the Railway Survey the Kikúyu escarpment; it is here 800 feet in height, but is broken by a terrace 300 feet from the base. Further to the north the terrace

thins out, but it soon reappears as the grazing plateau of Kinangóp. This is limited to the west by a low cliff face, which Gedge has called the Kinangóp escarpment. The much higher cliff which forms the eastern boundary of the plateau may be conveniently named after Settima, which rises just above it. North of the Maléwa (Murentát) the two cliffs unite, and are continued northward as the great Laikipia fault-scarp; this is broken in places into a series of parallel steps, as east of Njemps, but they appear to reunite when followed northward beyond the country of the Wasuk.

In many parts of the valley the walls are so precipitous that not even the most expert of cragsmen could scale them. This is, however, interrupted in two ways: in one the single fault-scarp is replaced by many smaller parallel ones, such as those which form the foothills of Kamasia and Laikipia, east and west of Njemps. In the second type the steep cliffs are replaced by a series of gentle slopes. The most striking case of the latter is that by which the middle road to Uganda ascends on to Mau; on the opposite side of the valley to this, is the track by which Thomson reached the plateau of Laikipia. The difference is entirely due to the geological disposition of the strata; the middle road simply follows a valley formed by a synclinal fold, which crosses the rift-valley in an approximately north-west to south-east direction. A similar synclinal appears to occur north of Baringo, and is probably continued to the west by Kimama (Lake Salisbury) and the Masange chain of lakes.

The two cliffs that bound the rift-valley were originally spoken of as mountain ranges, a term which has clung especially to the western line. It is, however, gradually being replaced by the term "escarpment," though in most German maps *kette* is still adopted. The use of the word "escarpment" is, however, not correct. At the Kedong and opposite Baringo the walls of the valley, though due to faults, may be regarded as escarpments, the rift-valley lying along the axis of an anticlinal. Elsewhere, however, they are decidedly not escarpments; thus opposite Nakuro the valley is a faulted synclinal, or, more strictly, a faulted centroclinal. The walls on each side are formed by a dip slope, interrupted by a series of cliffs formed by a parallel series of faults.

To apply the term "escarpment" to such a valley wall as this is a complete inversion of its exact meaning. The only correct term, as far as I am aware, which can be correctly applied is "fault-scarp;" but this ought to be restricted to the steep cliff portions of the valley wall, and not to the slopes between them. A new term is needed for the wall as a whole.

The Lake Basins.—It has already been pointed out that the rift-valley is crossed by a series of transverse folds; it is, therefore, only natural to find that the floor of the valley has been cut up by these

into a series of distinct basins, each of which is or has been occupied by a lake.

In the area under consideration there are four main basins. The descent from the Kikúyu fault-scarp leads to one which is bounded to the north by Doenyo Longonót and the ridge from which it rises; its southern limit is as yet unknown. This basin is now occupied by a level sandy plain, through which flows the river Kedong. It was, however, once the site of a vast lake, the raised terraces of which may still be seen. I propose to name this lake after Professor Suess, who has helped so largely toward the better understanding of the geology of this region of Africa.

On the north side of the Longonót ridge is the basin of Naivasha,* which is the best known of all the lakes of this series, and has been repeatedly visited by Europeans. The basin is limited to the north by the great volcanic pile of Doenyo Buru and a line of lava cliffs that runs thence to the north-east. These form to the south the long drainage slope of the Gilgil river, while they face the north with the cliffs above Elmetaita. The Naivasha basin is, therefore, bounded to the south by a fold, and to the north by a fault river.

The next basin is that occupied by the lakes Elmetaita and Nakuro, which are separated by a ridge. The walls of this basin present a very different aspect to those of Naivasha, for the dip of the beds is here toward the valley, so that it is a synclinal, with the sides broken by meridional trough faults. Moreover, the main synclinal is here traversed by a secondary one at right angles to it, so that the basin is really a great centroclinal. The extensive volcanic action and faulting around Elmetaita rather obscures the arrangement, which is better shown around Nakuro.

An anticlinal ridge to the north of Elmetaita and Nakuro separates them from the great basin of Baringo, which has now been split up by faults into at least four sub-basins. The first of these occupies the south and south-western parts of the basin. It is occupied in the main by a series of swamps surrounded by terraces; some of the swamps lie in completely isolated depressions, while others discharge into the Miviruni or the Nyuki, which drain the western side of the Baringo basin. The usual caravan route to Baringo lies across this district.

Running almost due north from near the camp at Miviruni is a long ridge sloping to the west, and facing the east with a vertical fault face. As this ridge is of great importance in the structure and geology of the basin, it is advisable to give it a name; as I could learn of no native one, and the district is rarely inhabited, I propose to call it the Equator Ridge, and the peak at its south end the Equator Peak, as it is almost

* *Naivasha* is the Masai word for "lake," just as *Tana* in Kipokomo means "river;" hence to speak of Lake Naivasha or the Tana river is tautologous.

upon the line. The ridge cuts off the south-east corner of the Baringo basin, and is occupied by a small lake, which was visited and not named by Teleki and Von Höhnel; it is known to the natives as Kibibi, but this sounds much like a Swahili name.* The basin is broken upon the west side by a series of fault-scarps parallel to the Equator Ridge. This sub-basin is of considerable interest from the diagrammatic simplicity of its structure; it is really a secondary rift-valley within the major one.

The third sub-basin is occupied by the lake known to the natives as Lake Losugúta (or possibly to one tribe as Lake Gonionábur), and in Europe as Lake Hannington. This is bounded to the east by the highest and steepest cliff face in the district, from the summit of which we enjoyed the grandest and most beautiful view which I saw in Africa, and which fully atoned for the extra marches and hardships, and the scarcity of water, during our journey over the faulted ridges of this district. At our feet, at the base of a precipice over 1900 feet in height, lay the long river-like lake, reminding me somewhat of our own Windermere. As a rule the colour effects in Africa were disappointing, but here was certainly an exception. The colour of the water is an exquisite blue, rivalling that of an Alpine lake, and suggesting at once its great depth and the minuteness of its floating impurities; the blue was broken by the dark green of the flat-topped acacias that cover the numerous islets, by the lighter green of vast floating masses of algæ, and by a number of delicate pink patches. These puzzled me much as I watched them at a distance, but on closer examination they turned out to be vast flocks of flamingoes. In striking contrast to the colour of the lake is a series of low white cliffs on the western shore, which are probably composed of silicious sinter deposited by the hot springs. Above these cliffs the ground is cut up by a great number of parallel step faults, and terrace rises above terrace, and tier above tier, till the whole of the western shore looks like a great amphitheatre rising to the summit of Doenyo Lugurumut level with our camp. Still further to the west, across the valley in which lies the ordinary caravan route, rises the dark grey escarpment of the rich food-bearing plateau of Kamasia. This can be followed past the bold outline of Doenyo Lubukwe and across the green swampy steppes of Njemps, till far to the north it slowly sinks to the transverse synclinal, the southern limb of which forms the northern end of the basin of Baringo. To the north of this is the basin in which lie the vast salt steppes of Sukut, which is probably another centroclinal like that of Elmetaita and Nakuro.

The floor of the valley has thus a very complex structure, and it is only natural to find that the rocks of which it is composed, and

* If so it would mean "little lady," but it is difficult to see how it could be used in this connection, unless it were a reference to the mosquitoes that abound there.

consequently the scenery, are both very varied. The harder rocks are all volcanic, and consist either of more or less perfect craters, the remains of denuded cores, long ribs of rock thrown by faults across the valley, and lava streams retaining their original extent and character. The greatest extent, however, superficially is occupied by alluvial and pleistocene deposits, consisting of expanses of blown sand, alluvium, talus fans, and beaches around the existing and former lakes. Along the river-courses there are thick beds of gravel and brick-earth, with layers of fine porcelain clay, which is in places baked to porcelanite by the lava streams that have flowed across it.

The Lakes of the Rift-Valley.—Leaving the structure of the valley, let us turn to the lakes along its floor, of which there are six—Naivasha, Elmetaita, Nakuro, Kibibi, Losuguta (Hannington), and Baringo; but in addition to these there are four others, which are now dry. Of the first series Naivasha is by far the best known, though our knowledge of its fauna is very limited; it is generally reported that it contains neither fish nor crocodiles, a view which has doubtless helped the acceptance of the view of its formation being due to barriers of volcanic *débris*, having dammed back the waters of the two streams that enter its northern end.* Dr. Fischer, however, says † that some small fish are fairly common in it.

The lake is roughly lozenge-shaped in form, and covers an area of 70 square miles. Its altitude I calculate to be 6200 feet. It is given by Thomson at 6000 feet; by the Railway Survey at 6350 feet; and by Von Höhnel at 6100 feet. It receives the waters of two rivers, the Malewa or Murentat, and the Gilgil, which enters the northern end, and two streams on the east side. The southernmost of these flows through a somewhat deep cañon, but in its lower course it is above the level of the surrounding country. In spite of the fact that the lake has no visible outlet, the water is quite fresh.

The lake is well known, as it has been repeatedly visited since its discovery by Fischer; it has been mapped with care by Von Höhnel and the Railway Survey; while a large manuscript map, by Mr. Gedge, is in the possession of the British East African Company. As to the origin of the lake, there has been some difference of opinion. Thomson and Gibson regard it as due to the damming back of the waters of the Gilgil and Malewa, by the *débris* that fell during the eruptions of Longonót.‡ The Railway Survey, however, showed that it is not so shallow as was thought, but that in the centre there is a submerged crater, which I had independently suspected from a view from the summit of Longonót. The southern limit of the basin is unquestionably formed by the ridge

* Thomson, 'Masai-Land,' edit. 1887, p. 199.
† 'Mitth. Geogr. Gesell.,' Hamburg, 1882–3, p. 78.
‡ Thomson, *op. cit.*, p. 193; W. Gibson, Rep. Proc. Brit. Ass., 1893, p. 758.

crowned by the crater of Longonót; but this ridge is not a mere pile of volcanic ejectaments, but has been formed by "negative elevation," *i.e.* it remained fixed during the subsidence of the ground to the north and south.

Elmetaita (*syn.* Angata Nairogua) is now a small lake, only 6 miles in length and 2 miles in breadth. It is bounded to the east by a vertical fault-scarp of very recent date; its west shore is low, and the lake once extended far to the westward, over what is now a level, sandy, salt steppe. Its waters are very bitter, and it contains a good deal of carbonate of soda. Two streams flow into it, the Kariandusi at its south-east corner, and the Guaso Nagut at the north end; the former drains a valley between the fault-scarps of the Dondole mountains, and the latter the area to the south of the Menengai anticlinal. The western boundary of the basin is a fault-ridge, which separates it from that of Lake Nakuro.

The shore of the lake is covered with grasses and sedges, while its waters yield masses of a green alga, some small amphipods, and insect larvæ. The altitude is given by the Railway Survey as 6000 feet, and by Von Höhnel as 6037 feet; my boiling-point observations on the shore place it at 5880 feet.

Lake Nakuro, or Nakuro Sekelai. This is a close neighbour of Elmetaita, and was no doubt once connected with it. It occupies a centroclinal depression on the west side of the rift-valley, the drainage of which it receives by three small rivers. The lake is at present about 9 miles long and 4½ broad. Its altitude may be estimated at 5860 feet; its water is said to be very salt. Nothing is known of its flora or fauna.

Lake Kibibi is the next of the series. It was discovered by Teleki and Von Höhnel, who visited it from their camp at Miviruni. They did not name it, and the only writer who appears to have referred to it is Professor Suess. Höhnel has only dotted its outline, and remarks that it is sometimes dry; but as it was approximately of the same size when I visited it at a very different season of the year, I should doubt if it is ever quite dry. It must at one time, however, have covered thrice its present area. Several valleys lead down to the lake, but, though it rained heavily every day while I was to the south of it, the stream-beds were all dry, and it is probably mainly supplied by springs upon its floor. It appears to be very shallow. We could not find any fish in it. The altitude is 4820 feet.

Lake Losuguta is the longest lake in the series, and by far the most beautiful and interesting. But, though near the great trade route to Njemps, it has been always missed until it was discovered by Teleki and Höhnel, who visited its northern end. It was correctly marked on Von Höhnel's map, but the Railway Survey have not only missed it, but in the index map runs two rivers across its site.

A lake is marked by Thomson and Ravenstein a little to the north

of this, which I thought must be intended for it; but the total difference in size and shape, as well as in position and in the rivers that enter it, shows that this cannot be the case. Their lake really represents the swamp to the east-north-east of Njemps, which it does fairly accurately. The two rivers, however, that enter it from the south and east of "Donyo Lugurumut" have no existence, as they flow across the site of Lake Losuguta.

Von Höhnel's map well shows its general proportions, though the outline requires many alterations in detail. He does not mark any river as entering the lake, whereas one flows into the north end, which is second in volume amongst those of this part of the rift-valley only to the Malewa. It was so deep and rapid where we wanted to cross, that we were delayed till we could find a place sufficiently narrow to bridge. Until its correct name be discovered, it may be referred to as the Hannington river. It rises near the south end of the lake, on the great plateau on the eastern side, north of my fiftieth camp. It thence flows down a narrow valley for probably 7 miles to the north; it then bends sharply back to the south, passes between the main escarpment and a group of foothills seen from the camp at "Maji Moto," and enters a swamp at the north end of the lake. In this its course is broken by some rapids and an 8-foot waterfall.

The water of the lake is said by Von Höhnel to be lukewarm, but at its south end it was slightly cooler than the air at eleven o'clock in the morning. Its waters are intensely disagreeable to the taste, with a putrid sulphurous flavour, and acted as a very prompt emetic upon the men who drank any. Both Höhnel and Thomson record hot springs in this locality, but though I saw what appeared to be such at the south end of the lake and on the east shore, I was not able to reach them.

The lake is about 10 miles long, and its breadth varies from 1 to $3\frac{1}{2}$ miles. The water is often of a bright green, owing to the number of algæ that live in it, but I was not able to find any animal life within it.

The altitude of the lake, as determined by boiling-point observations, I calculate at 3050 feet. The water was standing at the time some feet above its normal level, as trunks of dead trees with the leaves still hanging stood out in the lake, while acres of yellow rotten grass were submerged along the shore. From this mass of decaying vegetation there arose a stench which, combined with the intense damp heat and the long march without drinking-water, told severely on the health of the men.

Lake Baringo is the most northern of this series, and is also the largest in extent. The first European who reached it was Mr. Joseph Thomson, who determined its true extent and the absence of the asserted connection with the Victoria Nyanza. It was subsequently visited by Teleki and Höhnel. Mr. Thomson went round the lake, but he was busy elephant-shooting, and was often some distance from its shores.

Teleki and Höhnel passed at a little distance from its western and eastern sides. The maps of these travellers showed such striking differences in the shape of the lake, the rivers that flow into it, the distribution of its islands, and the arrangement of the mountains on its eastern shore, that I resolved to follow its shore-line to settle these points in its topography. I had also intended to survey the passes that lead northward on to the steppes of the salt plains of Sukut, in order to determine the line of its probable outflow to the north. A scare of a Wasak raid, however, led to the mutiny of the ten men I had with me, and I was for a while left with only a Mkauvi guide. I could not venture, therefore, far from the lake.

Baringo is 15 miles long and 8 miles broad; it covers about 100 square miles. Its altitude, from my aneroid readings, taken at the same hour on following days so as to avoid diurnal variation, show it to be 120 feet lower than Njemps Ndogo. The elevation of this, my boiling-point observations determine as 3320 feet above the sea Thomson gives the altitude of the lake at 3217 feet, Von Höhnel at 3660 feet, and the Railway Survey as 3300 feet, while I make it to be 3200 feet.

The river-system of Baringo has been very differently represented by previous cartographers. Thomson says that five rivers enter it; Von Höhnel and the Railway Survey reduce the number to three; Ravenstein retains five, but arranges them differently to Thomson. I could, however, only find two, the Guaso Tigirish and the Guaso Boli, which are as represented by Von Höhnel. Both this author and Thomson show a river entering the north-east corner of the lake. The former calls this the Mugutan, having as a tributary the Seremas, while Thomson names it the G. Mogodeni. It, however, never reaches the lake. At the point where they mark its mouth there is really an outlet, as when the lake is high the water drains into the porous lava sheet, which here runs down to the shore. The Mugutan is probably lost in the same lava sheet. The mistake, no doubt, arose from both explorers mistaking the fertile level lava plain for a tract of alluvium beside the mouth of a river.

The Guaso Nyuki does not reach the lake, but is lost in a swamp east of Njemps Mkuba. A little north of the Guaso Boli there is a dry stream-bed, which must be a powerful torrent after storms. It has not been marked on previous maps. Its name is the Guaso Duk.

The course of the Guaso Ndau has also been misunderstood. It is a tributary of the G. Tigirish, which it reaches in the swamp near its mouth. It was omitted from Von Höhnel's map, but where we crossed it was a rapid stream 3 feet deep and 12 yards wide, and flowing between banks raised above the level of the surrounding plain. It receives the drainage of the Mkuyuni valley and parts of the Kamasia foothills; but it must have a subterranean course, as for some distance its bed is dry. Its upper branches appear to have been called

the Kamnye and the Susien or Suseira; but from my guide and the people at Njemps Mkuba, I could only get the name Ndau.

The islands in the lake are of considerable interest, as the main series appear to be the remains of a volcanic crater broken up by faults as well as ordinary denudation. I was disappointed at not being able to get into communication with the Wakauvi, who inhabit them, and thus had to be content with a distant view. There are nine islands in all, of which six form a small archipelago near the southern end. The largest, highest, and central is named Langari; it is crescentic in shape, and has a steep inner and more gradual outer slope. Sections at its broken end show what are probably lava beds between layers of volcanic ash; the whole seems to have a quaquaversal dip. North of Langari are two small islands known as Loel Divis; to the east is a long narrow one named Mandadu; to the south-west is Lukrum.

The islands at the northern end are near the shore, and are merely bosses of lava that have been separated from the shore ridges by denudation. The two largest are named Somiten and Logobiti.

The last point on the topography that has to be noticed is the character of the east shore. Von Höhnel shows a mountain chain here running right down to the lake; but a tract of alluvium more than two miles wide separates it from the fault-scarp, which forms the western margin of Doenyo Lersubugo, which is here the lowest of the foothills of Laikipia. An island-like boss of lava rising from the plain forms a conspicuous feature on the eastern shore, and is known as Logwamara.

It has been remarked several times during the description of the present lakes, that these were once far more extensive than at present. Baringo especially must have had a much greater extent, and once had an outlet to the north.

There is evidence, moreover, of the former existence of a series of lakes which are now quite dry. The largest of these is south of Lake Naivasha, and it must have far exceeded in size all the existing ones put together. Its extent is shown by a series of lake terraces high up along the sides of the fault-scarps of the rift-valley. The lake must have extended right across the valley; its southern limits are quite unknown, while that to the north is very uncertain. It may have been continuous with Naivasha, or have ended against the Longonót anticlinal. I propose to name it Lake Suess, after the distinguished geologist who has thrown so much light on the geology of East Africa.

Another dry lake basin exists near Miviruni, to the north of Nakuro and west of the Kibibi basin.

Summary of Classification of the Lake Basins—

Naivasha, Baringo } transverse synclinals faulted in along the axis of a meridional anticlinal.

Elmeteita, Nakuro } together occupy a centroclinal.

Kibibi
Losuguta } secondary rift-valleys on the floor of the major rift-valley.
Miviruni

The Mountains of the Rift-Valley.—Excluding fault-ridges and lava streams, the mountains of the rift-valley consist solely of volcanic craters, which are disposed in the main on a north and south line.

The southernmost is the vast mass of Doenyo Suswa, opposite the fault-scarp of Ngongo Bagas. It has a width at its base of 9 miles, and its height is estimated by Von Höhnel at about 7870 feet. Its north wall is breached, and a smaller crater has been developed within it.

North of this is a much older cone, composed of a red andesite and rhyolite, to the colour of which it owes its name of Doenyo Nyuki ("Red Mountain"). On the lower flanks are some beds of pumiceous volcanic ash and tuff, and on the south side a prettily wooded gorge has cut through a parasitic cone, giving a section of diagrammatic clearness. The mountain is now only about 640 feet in height above the valley floor, but it must once have been very much higher.

Three miles to the west of the foot of Doenyo Nyuki is the lowest and most recent of the lava flows from Doenyo Longonót, the largest and most perfect crater in this part of the rift-valley. It was visited by Thomson, who climbed to the rim of the crater, the height of which he estimates at 9000 feet. I succeeded in gaining the summit of the highest pinnacle; boiling-point determinations gave its height as 9350 feet, which is 2140 feet above the summit of the pass at the east foot of the mountain, and 3000 feet above that of the surrounding plain. The rim of the crater is not so sharp as it appears to have been at the time of Thomson's visit, for the zebras have worn a fine cinder track round its level part; the jagged north-western part of the crater is covered in scrub. The crater walls vary from 300 feet on the south, to 1000 feet on the north-west.

On the inner north wall of the crater is a powerful steam-jet, which may be on the same line of weakness as a remarkably perfect parasitic cone on the north slope.

The mountain is of some interest, not only from being probably the last of the series in age, but from the very high proportion of lava in its mass. Beds of volcanic ash play a very subordinate part in the structure of the cone.

North of Doenyo Longonót there is a considerable number of volcanic cones in the district of Ndabibi to the south-west of Naivasha. Hot springs are said to occur there by the Masai, and Mr. Martin tells me that he has seen "smoke" rising from some of the cones. This may indicate dust-coloured steam. The cones in this district are small.

Doenyo Buru is comparable in size to D. Suswa and D. Longonót.* It is situated to the north of Naivasha. Its height is estimated at 9000 feet by Thomson, and 7870 feet by Von Höhnel. It has been subjected to great denudation, and is certainly older than Longonót. On its north side are a series of steam vents, which must cover several acres in extent. The steam is attributed by the Swahili porters to Wanderobbo fires, but this is clearly incorrect.

At the south-west end of Elmeteita is a group of three faulted and denuded craters. The south-eastern one, which we may call A, consists of the crescentic north wall and a cone, which may be the remains of the central core. This crater must have risen 1800 feet above the level of the plain. The second member (B) is the most perfect of the group. It consists of a crater wall, which, though now broken up by faults and erosion, can be traced all along its former extent. A double cone rises in the centre of the crater floor.

North of Lake Baringo is yet another series of denuded basic cones, forming the Erri mountains. The cores of this group have been exposed by faults, but many of the lava streams are surprisingly fresh, and some of the craters of the steam vents on the flows are perfectly preserved. They seem to be later in age than the period when Baringo had an outlet to the north. They are older than the second set of meridional faults, which has had such a marked influence on the scenery and topography of the district.

(To be continued.)

EXPEDITION TO THE HADRAMUT.†

By J. THEODORE BENT.

In the proper acceptation of the term, the Hadramut at the present time is not a district running along the south-east coast of Arabia between the sea and the central desert, as is generally supposed, but it is simply a broad valley running for 100 miles or more parallel to the coast, by which the valleys of the high Arabian plateau discharge their

* The synonymy of these three peaks is a little confused, as is shown in the following table:—

Thomson.	Von Höhnel.	Railway Survey.	Gregory.
Lolbotat.	—	—	Lolbotat.
Longonót.	Longonót or Lolbotat.	Longonót.	Longonot.
—	—	—	Doenyo Nyuki.
Doenyo Nyuki.	Sausswa.	Suswa.	Suswa.

† Paper read at the Royal Geographical Society, May 21, 1894. Map, p. 384.

not over-abundant supply of water into the sea at Saihut, towards which place this valley gradually slopes.

Owing to the intense fanaticism of the inhabitants, this main valley has been reached only by one European before ourselves, namely, Herr Leo Hirsch, in 1893. In 1846 Von Wrede made a bold attempt to reach it, but only got as far as the collateral valley of Doan. My wife and I were the first to attempt (in the latter part of 1893 and the early part of 1894) this journey without any disguise, and with a considerable train of followers, and I think, from this very reason, we made more impression on the natives, and were able to remain there longer and see more, and establish relations with the inhabitants, which, I hope, will hereafter lead to very satisfactory results.

There is every reason to believe that anciently, too, the Hadramut meant only this valley; we learn from Himyaritic inscriptions that five centuries B.C. the name was spelt by the Himyars as it is now (namely, $\overset{t}{\text{X}}\ \overset{m}{\text{Ⅱ}}\ \overset{r}{)}\ \overset{d}{\text{Ⅱ}}\ \overset{h}{\psi}$), and meant in that tongue "the enclosure or valley of death," a name which in Hebrew form corresponds exactly to that of Hazarmaveth of the tenth chapter of Genesis, and which the Greeks, in their usual slipshod manner, occasioned by their inability to pronounce a pure *h*, converted into *Chatramitæ*, a form which still survives in the Italian word *catrame*, or "pitch." The Hadramut was then chiefly celebrated for the exudations of its trees, and was the centre of the ancient trade in the various species of frankincense and myrrh. It had for its capital in the main valley a town called in the inscriptions Shabwat, on the confines of the desert, also written by ancient authors Sabbatha, Shaba, and Sabota. Hamdani tells us, in his 'Geography of the Arabian Peninsula,' that there were salt works at Shabwa, and "that the inhabitants, owing to the wars between Himyar and Medhig, left Shabwa and came down into the Hadramut, and called the place Shibam, which was originally called Shibat." Shabwa is now a deserted spot, save for Beduins, who still work the salt six days westwards from Shibam in the main valley, and the effect of salt is recognizable in the waters of all the wells of the main valley. We found an inscription at Shibam in which the name $\overset{sh}{\text{Σ}}\ \overset{b}{\text{Ⅱ}}\ \overset{m}{\text{Ⅱ}}$ occurs, certainly dating from the third century B.C.; we may therefore argue that if Shibam was not the site of the original capital, it was at any rate a place of considerable importance centuries before our era, the centre of the frankincense trade, where the caravans were made up which brought the produce westwards by the great frankincense road across Arabia, accurate geographical details concerning which are given us by Claudius Ptolemy. Pliny gives us also a similar account, but says their capital was Thumna, which is also correct, as Thumna was the capital of the Gebaniti, a Himyaritic tribe west of the Hadramut, and the lords of the Hadramut were vassals of the Gebaniti. Of this fact

we got interesting confirmation at Shibam in the seal of "Yasarhal the Elder of Shibam," for in an inscription published by M. Halévy we have the two Yasarhals and various members of this valley described as vassals of the King of the Gebaniti. These facts are especially interesting, as satisfactorily proving the accuracy of the ancient geographers concerning this Arabian valley which supplied the world with frankincense.

Broadly speaking, the district which we travelled through divides itself into three distinct portions. Firstly, the narrow coast-line, or Sahil; secondly, the high plateau, or Akaba; and thirdly, the Hadramut and the collateral valleys running into it from the plateau from the south, and from the central desert to the north.

Of these, the first is the most uninteresting. We traversed nearly the whole of the coast-line from Mokalla to Saihut, and a more uncompromisingly arid country I never saw. The most prominent feature of this coast-line is the numerous hot springs which are found here, showing volcanic agency. The most considerable of these fertilizes a large district about 10 miles inland, where the inhabitants of the town of Ghail ba Wazir exist on the cultivation of tobacco, called "Hamumi tobacco from the neighbouring Beduin tribe," and many acres of waste land are brought into cultivation by conducting the hot streams by underground channels, similar to the Persian *kanats*, in various directions about the plain. At the village of Hami, 13 miles east of Sheher Bunder, the water is so hot when it comes up from the ground that the hand can hardly bear it, and the cultivation wherever it is conducted is extremely abundant. At Dis, too, and at several other points, these running warm streams lend a precarious existence to a sparse population; but the rest of this district is nothing but sand and arid waste.

The fishing villages on the coast do, however, a considerable trade. The inhabitants dry small fish on the shore, and sell them to the Beduins who come down from the mountains, who carry them back in sacks to feed themselves and their camels in the dry season, and it is interesting to see the Beduin and his camel feeding out of the same basket on these fish. Fish oil is another very repellent production of this coast, and the odours produced by these industries are a particularly unpleasant feature of the fishing villages. Mokalla, Sheher, and Kosair are the chief towns of this district, and they carry on an active trade, with their dhows and buggalows, with Aden, Muskat, Bombay, and the Somali coast. Near Kosair a peculiar geological feature is observed in a vast area of black basaltic rock, which stretches over the flat country for miles like a field of lava. This effusion of basalt near the coast may very possibly be the source from whence the Egyptians and Assyrians got their basalt for statuary purposes. The Arabs of to-day say that this stretch of basalt is the ashes of Pagan cities. As Saihut is approached, the mountains come down close to the sea at the outlet of the great Hadramut valley. We looked earnestly for traces of antiquity along this coast-line, but, in

spite of the assertion of their existence in 'The Red Sea Pilot,' we found none, and therefore concluded that the author mistook the ruins of mud villages and towers, of which there are many, for remains of an anterior civilization. We offered money to the Beduins to show us any remains; but in spite of their keen desire to obtain our money, they were unable to show us anything, and always affirmed, "There are no Addite ruins here but in the Hadramut." The people of Ad is the name given in the Koran to the old Sabæan inhabitants of Southern Arabia, and the term Addite is still applied to all their ancient remains. The negative evidence of the non-existence of ruins here is, however, in itself satisfactory, and confirm the opinion that the ancients made little or no use of this barren and almost harbourless coast, but carried on all their trade with the frankincense country by means of the above-mentioned caravan road through the interior.

The second feature of this district is much more geographically interesting, namely, the great *akaba* or high plateau which separates the Hadramut valley from the coast. It is approached by numerous short waterworn valleys, by which the various caravan roads into the interior commence the journey from the coast. We ascended the Wadi Howari, which is the largest and longest of these; and then, after a rapid rocky ascent of two days—for progress with our long train of camels was but slow—during which a few Beduin villages were passed, we reached the plateau, which extended in every direction in a flat, unbroken line as far as the eye could reach. Beyond the fact that this plateau is divided, so to speak, into two stories, the higher story being sometimes in isolated hillocks, and sometimes in long level stretches about 80 feet higher than the lower one, this vast extent of plateau is absolutely featureless. No distant elevation breaks the horizon; there is not a single habitation on it or sign of life; it is absolutely waterless except after the rains, when rain-water is preserved in tanks dug along the paths, which get dry after the long droughts, and cause the traveller infinite discomfort.

Haibal-gabrain, our first point of halt after reaching the plateau, we ascertained, is the highest point of the whole plateau. Here it reaches an elevation of 4150 feet; it slightly slopes northwards towards the main valley, and eastwards towards the Wadi Adim, and then rises again and extends for as yet an unknown distance. On the top level of the akaba there is no vegetation whatsoever, and it is in many parts scattered with small black basaltic stones as if by a gigantic pepper-pot, resting on the sandy soil, sandstone, and limestone, of which the range is formed. In the gullies between the upper and lower stories, and at a slightly lower level at the mouths of the valleys, we found a certain amount of vegetation. Here are the frankincense and myrrh trees, and various forms of mimosa, and undoubtedly this is a portion of the district which yielded the ancient wealth of the country. The further east

we went the more frankincense trees we found growing, and I have reason to believe that a still large amount of this is still obtained from the Hasik district east of the Hadramut valley. It is a curious fact that the Beduins who own all this plateau do not themselves gather the produce of the trees, but let out districts to Somalis, who come over during the proper season to collect it. In ancient times we are told, by the anonymous author of the 'Periplus of the Red Sea,' that the frankincense was only collected by slaves, which gave rise to the quaint Greek legend that the fumes of the frankincense trees were deadly, and that for this reason the Hadramut was called "the valley of death."

Here and there along this plateau we came across a few Beduin women tending miserable, half-starved flocks. Here and there, in a few favoured nooks, vegetation struggled on at a terrible disadvantage; otherwise it is an absolutely deserted and unproductive district, almost oppressive in its vast solitude, but with a fresh, keen air that invigorated us after the heat of the coast. It appears to me highly probable that the systematic destruction of the frankincense and myrrh trees through countless generations has done much to alter the character of this highland plateau, and has contributed much to the gradual silting up of the Hadramut and its collateral valleys, to which fact I shall have again occasion to refer. The aspect of this plateau forcibly recalled to our minds that portion of Abyssinia which we visited last year; there is the same arid coast-line between the sea and the mountains, and the same rapid ascent to a similar absolutely level plateau, and the same draining northwards to a large river-bed—in the case of Abyssinia, into the valleys of the Mareb and other tributaries of the Nile, and in the case of this Arabian plateau, into the Hadramut. Only Abyssinia has a more copious rainfall, which makes its plateau more productive than the one before us. This high plateau is unquestionably the Maratha Mountains of Ptolemy, and Pliny tells us further (XII. 14. § 52), "In the centre of Arabia live the people of Hadramut, a tribe of the Sabæans, in an exceedingly high mountain."

As we proceeded northwards we soon began to come across the heads of the many valleys which run into the Hadramut; the Wadis Doan, Al Aisar, Al Ain, Bin Ali, and Adim all start from this elevated plateau and run nearly parallel. The curious feature of most of these valleys is their rapid descent; they appear as if they had been taken out of the high plateau like slices out of a cake. They do not appear to have been formed by a fall of water from this plateau; in fact, it is impossible that a sufficient force of water could ever have existed on this flat surface to form this elaborate valley system. In the valleys themselves there is very little slope, for we found that, with the exception of the Wadi Adim, all the valley heads we visited were nearly of uniform height with the main valley, and had a wall of rock approaching 1000 feet

in height, eaten away as it were out of the plateau. We were, therefore, led to suppose that these valleys had originally been formed by the action of the sea, and that the Hadramut had once been a large fiord or arm of the sea, which, as the waters of the ocean receded, formed an outlet for the scanty water-supply of the Southern Arabian highlands. These valleys have, in the course of ages, been silted up by sand to a considerable height, below which water is always found, and the only means of obtaining water in the Hadramut for drinking purposes, as well as for cultivation, is by sinking wells. The water of the main valley is strongly impregnated with salt, but is much sweeter at the sides of the valley than in the centre. No doubt this is caused by the weight of the alkaline deposits washed down from the salt hills at Shabwa, at the head of the main valley.

The steep reddish sandstone cliffs which form the walls of these valleys are themselves almost always divided into three distinct stories or stratifications, which can be distinctly seen on the photographs. The upper one is very abrupt, the second slightly projecting and more broken, and the third formed by deposit from above. The descent into the valleys is extremely difficult at all points. Paths down which camels can just make their way have been constructed by the Beduins, by making use of the stratified formation and the gentler slopes; but only in the case of the Wadi Adim, of all the valleys we visited, is there anything approaching a gradual descent. We came down into the Wadi Al Aisar, one of the narrower ones, where there are numerous villages belonging to the Beduins of the Khailiki tribe, several members of which formed our escort. The first peep down from the edge of the plateau into these very highly cultivated gullies is most remarkable, quite like looking down into a new world after the arid coast-line and barren plateau. At our feet we saw lines of villages and palm groves; behind us we looked for the last time for many weeks on the bare monotonous plateau. After a very difficult descent on foot, we reached the village of Khaila, and encamped for two days close to the house of the chief of the tribe. Even here we were struck with the large houses and fortresses constructed by the Beduins, some of them three or four stories high, with the antlers of antelopes stuck on at the corners, and our surprise was the greater because we had looked upon the Beduins on our journey as little better than naked savages.

The Bedu of the Hadramut is very different to that of Northern Arabia. He is small, thin, and wiry, naked save for a loin-cloth, and with long matted hair, which he ties up behind his head with a leathern band. On his shoulder he carries his quaint matchlock gun, and attached to his waist girdle he has his powder and priming flask; his dagger and his arms and legs are decorated with various ornaments of brass and iron. He has much about him that reminded us of the aboriginal races of Asia Minor and Northern Persia. His conversion to

Mohammedanism is merely nominal. It is rare to see a Bedu say his prayers or perform the ablutions inculcated by the religion of the country; he does not in the least object to travel or work during Ramazan, and he never fasts; and yet at the same time he has his own religious secrets, his own particular points of religious veneration, which, like the Yoruks of Asia Minor, he prefers not to communicate to strangers. The pious Arab speaks of them as heathen; but they are distinctly powerful, and often treat the Arabs and their religious observances with undisguised contempt.

Before proceeding further with our journey, I will here say a few words concerning the somewhat complex body politic of this portion of Arabia, the inhabitants of which may be divided into four distinct classes.

Firstly, there are the numerous wild tribes of Beduins scattered all over the country, who do all the carrying trade, rear and own most of the camels, and possess large tracts of country, chiefly on the highlands and smaller valleys. They are very numerous and powerful, and the Arabs of the towns are certainly afraid of them. They never live in tents, as do the Beduins of Northern Arabia; the richer ones have quite large houses, whilst the poorer ones—those in Shabwa and the Wadi Adim, for instance—dwell in caves.

Secondly, we have the Arabs proper, a decidedly later importation into the country than the Beduins. They live in and cultivate the lands around the towns; many of them carry on trade and go to India and the Straits Settlements, and some of them are very wealthy. They also are divided into tribes. The chief of those dwelling in the Hadramut are the Yafi, Ketiri, Minhali, Amri, and Tamini. The Beduins reside amongst them, and they are constantly at war with one another, and the complex system of tribal union is exceedingly difficult to grasp.

Thirdly, we have the Seyyids and Sherifs, a sort of aristocratic hierarchy, who trace their descent from the daughter and son-in-law of the prophet. Their influence in the Hadramut is enormous, and they fan the religious superstition of the people, for to this they owe their existence. They boast that their pedigree is purer than that of any other Seyyid family, even than those of Mecca and Medina. Seyyids and Sherifs are to be found in all the large towns and considerable villages, and even the Arab sultans show them a marked respect and kiss their hands when they enter a room. They have a distinct jurisdiction of their own, and most disputed points of property, water rights, and so on, are referred to their decision. They look with peculiar distrust on the introduction of external influence into their sacred country, and are the obstructionists of the Hadramut, but at the same time their influence is decidedly towards law and order in a lawless land.

Lastly, we have the slave population of the Hadramut, all of African origin, and the freed slaves who have married and settled in the country. Most of the tillers of the soil, personal servants, and the soldiers of the sultans are of this class. They marry amongst themselves; their women never wear the veil, and mix freely with the men; many of them are well off and own good houses in the towns. They are all Mohammedans, and every new slave who is introduced into the country, if not a Mohammedan, is obliged to embrace that religion. They are not allowed to take Arabic names, but are generally known by nicknames indicative of some personal feature; nor can they ever hope to rise to a higher class. Notwithstanding this they live very contented and happy lives, especially the soldiers, who have considerable influence amongst the Beduins, and are provided with food, clothes, arms, and lodging by the sultans. Many of them have been in India, and served in the Arab regiment at Hyderabad, and acquired manners and education superior to those of the Seyyids and Arabs whose property they are.

The Al Kaiti family of the Yafi tribe is by far the richest in the Hadramut, and their history may be briefly given in a few words. About five generations ago, the Seyyids of the Abubekir family, at that time the chief Arab family in the Hadramut, claiming descent from the first of the Caliphs, were at variance with the Beduin tribes and in great difficulties, so they invited some chiefs of the Yafi tribe from the Yafi mountains halfway between the Hadramut and Aden to come to their assistance. The Al Kaiti family responded to their call, and by force of arms subdued the hostile tribes, and permanently established themselves in the main valley. Omar bin Aod Al Kaiti, the grandfather of three of the reigning sultans in the district, was a really powerful and wealthy chief. He built very fine palaces in the Hadramut at Shibam, Al Katan, Haura, and Hajarein, and his son, Sultan Nawas Yurg, the present head of the family, is now femadas or general of the Arab regiment at Hyderabad. This historical intercourse with India is the secret of the wealth of the Al Kaiti and other Hadramut families; they own properties in Bombay and other commercial centres in the East, and under their wing large numbers of the inhabitants of the valley flock to India and the Strait Settlements, where they make money more or less honestly and return to their birth-place to spend it. There is absolutely no source of wealth in the Hadramut itself, yet the valley is studded with fine palaces, and the influence of India is everywhere noticeable. Their furniture is largely imported from India, their jewelry is mostly Indian, their daggers are studded with gold mohurs; and the most peculiar feature of all this is that, in spite of this external influence, they remain fanatically opposed to the visits of Europeans into their country, and that their women by common consent never leave the country. There are instances on record of a man returning to the wife he had left in the Hadramut after an

absence of forty years, and marital separations of twelve and twenty years are of common occurrence. The marriage laws of Arabia, however, provide the emigrant with the means of getting out of this difficulty, and most of those who can afford it have their harems both at home and abroad.

The sultan Nawaz Jung, though residing in India, is still the recognized ruler of the country under the Yafi sway, and all important questions are referred to his decision by his three nephews, one of whom is Vice-Sultan at Sheher, the other at Mokalla, and the third at Shibam.

Sultan Sallah bin Mohamed, of Shibam, dwells in a very fine palace at Al Katan, about 12 miles from his capital, a most delightful and fascinating spot, surrounded by many acres of palm groves, and nestling beneath the rocky wall which shuts in the valley—quite the ideal home for an Arabian chief as described in the 'Arabian Nights.' Space will not permit me to give a minute description of these Hadramut towns and palaces, but they will be illustrated better by my wife's photographs than by any description I could give. There is a decided monotony about Arab architecture. Most of the houses are exceedingly high, some reaching eleven storeys; they are built of sun-dried bricks, and are externally decorated with chevron and zigzag patterns. There is always a terrace on the roof, where the people sleep in the hot weather, and they are usually decorated with turrets, domes, machicolations, buttresses, etc., which give them quite a mediæval appearance. Outside in the courtyards the flocks and herds are kept and the horses are stabled at night. The lower storey is devoted to the storing of goods, the second storey is inhabited by the servants, the third

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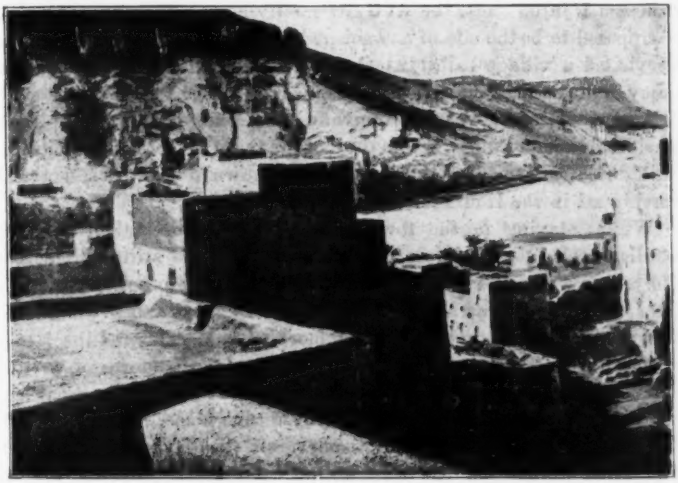
by the guests, and above that come the harem and the family dwelling-rooms.

The wood carving is very well executed. Most of the doors are elaborately carved; the unglazed windows are fitted with pretty tracery; the beams, the cupboards, the invariable coffee corner, and the household utensils, are all subjects for the carver's art, and in this they excel exceedingly. Dados, with quaint patterns, run up the sides of the walls, and each storey is furnished with its skin or *mussack* of water, which is hung in a draught so that the contents may be kept cool. Each storey, too, has its bathroom, where a big jar called *Kazba* is placed, and the bath taken by throwing water over the body by means of a smaller utensil. The drainage is lamentably deficient, and is carried by long wooden spouts into the yard below; the dry climate and sandy soil are the only security against disease. The palaces of the sultans and great men of the Hadramut are exceedingly imposing, and, when seen through the surrounding palm groves, form delightful pictures.

Sultan Sallah received us most cordially, and encouraged us to stay some time under his roof, so that we might more comfortably make excursions to places of interest in the neighbourhood. Of all the men we met in the Hadramut we found Sultan Sallah the most enlightened. He complained bitterly of the benighted life he had to lead amongst his rascally and fanatical fellow-countrymen, and took great interest in all our collections and varied pursuits. He greatly envied me the possession of a wife who could do other things besides paint herself with turmeric and antimony, and lead a listless life of seclusion and squabbles in the harem, and through us he made a formal request that a trained Mohammedan doctor might be sent to the Hadramut from India, whose presence there would do an immense amount of social and political good; and I am sure that if the Indian Government acceded to this request, Sultan Sallah would be prepared to bear the greater part of the expense himself. The medical condition of the country is terribly deficient. Burning the part affected with hot irons is a favourite remedy called kayya, and one which we saw frequently applied. Then, again, they have an idea that certain smells are dangerous for certain wounds, and those afflicted are obliged to wear stoppers in their noses for fear of inhaling the smell. On to a wound they will tie iron or tin; and as women are not allowed to see medical men, their husbands take a hair from their head, from which the doctors profess to divine what the lady is suffering from. Sultan Sallah told us of a curious case which had lately come under his notice. A man for a wager consumed all the fat of a goat, and when he was subsequently taken ill, the doctor ordered a fire of wood to be lighted all round him to melt the fat, which had congealed in his inside. During our prolonged stay at Al Katan, which off and on lasted for nearly a month, we were able to see a great deal of the life and customs of the inhabitants, their mode of agriculture,

and other points to which I could not do justice within the short limits of this paper.

Whilst waiting at Al Katan, it will be as well to review the principal archæological features which we observed in this district. In the Wadi Al Aisar we visited the remains of an extensive Himyaritic town, but unfortunately found no inscriptions. We saw nothing more of this character until we reached Hajarein, a town built on an isolated hill in the centre of the valley, which, as a continuation of the Wadi Doan, is thence known as the Wadi Kasr until it joins the main valley of the Hadramut. From here we visited the remains of a very extensive Himyaritic town called now Raidun by the inhabitants, being about two miles distant from Al Meshed, a somewhat sacred spot amongst the



HAJAREIN.

Arabs, into which the Seyyids would not allow us to penetrate. The ruins cover many acres of ground, and may be traced for a distance of two miles, and they showed us clearly the nature of the wholesale destruction which has come across the ancient civilization of the frankincense country. The ruins of certain lofty square buildings stand up on hillocks at isolated intervals; from these we got several inscriptions, which prove that they were the high "platforms" alluded to in so many Himyaritic inscribed stones raised in honour of their dead. As for the town around them, it has been entirely engulfed in sand; the then dry bed of a torrent runs through the centre, and from this fact we can ascertain, from the walls of sand on either side of the stream, that the town itself has been buried some 30 to 40 feet by this sand.

Wherever we found ruins elsewhere in the Hadramut, they were always on some elevated spot above the sand-level, so that we may argue therefrom that all traces of ancient civilization in the centre of the valleys lie deeply buried in the sand, which has come down into the valleys in devastating masses from the plateau and the central desert. The nature of the sand in this district is twofold: firstly, we have the firm sand which can be cultivated, or *loess;* and, secondly, the disintegrated sand from the desert, which forms itself in heaps and causes sandstorms when the wind is high. I think there is every reason to believe that this ruined city near Hajarein is the Θαβάνη of Ptolemy, the Toani of Pliny, and the Doan of Hamdaui, which name is still retained in the adjacent Wadi Doan.

From Hajarein to El Katan we saw no definite traces of antiquity, although Haura, where the Al Kaiti family have a magnificent palace, is supposed to be the site of an ancient Himyaritic town. From El Katan we visited a village called Al Gran, at the southern edge of the main valley, built on the foundations of a large Himyaritic fortress; it stood on a slight elevation above the plain, and must once have been a place of considerable importance. From the mosque there we got two inscriptions, one a dedication to the god Sayan, who is known to have been especially worshipped in the Hadramut in ancient times.

Whilst staying in the town of Shibam we were taken to see a peculiar rock in an adjacent valley, on which are still legible some Himyaritic words in red distemper. We noticed the peculiar position of this stone, blocking up as it does the end of a valley, and so placed that it would receive the first rays of the morning sun. This red inscription is of great antiquity, for it is in the boustrephedon form of writing, which at once relegates it, according to the best authorities, to at least the third century before Christ. On my return home, I found out, from Prof. Hommel's invaluable dictionary of the hitherto ascertained Himyaritic words, that one word meant "morning light" and another "sacrifice;" hence we had before us an undoubted site of an ancient sun-worship, and we were forcibly reminded of the large stone on the Zimbabwe ruins and its simular orientation.

The most interesting and productive expedition which we made from Al Katan was northwards up the Wadi Ser, in the direction of the central desert. The mouth of this valley is about six miles from Shibam, and even here it is a mass of loose shifting sand. As we proceeded northwards up the valley we found the traces of habitation few, the cultivation very scanty, and fields being prepared by scraping the ground with wooden boxes or ploughs, called *mishap*, attached by chains to camels. These boxes take off the upper layer of sand, and thus form dykes, which retain the rain-water if rain does fall. Sometimes it does not fall for three years, and their labour is in vain; but one favourable season in three years, they told us, repaid them for the trouble.

At the mouth of the valley a few Arab villages of the Katiri tribe can boast of palm-trees and fair-sized houses, but further in the whole of the valley is occupied by Beduins, and as you proceed up it the masses of sand increase; here it is shifting and loose in many places, and the hills on either side of the valley grow distinctly lower.

We penetrated up this valley to a spot called Al Had, where there is a solitary house and farm occupied by a Beduin tribe, and a deep and ancient well in the centre of the valley, which is the last water before the central desert is reached, and all around us stretched masses of sand and absolute barrenness. We were told by the Beduins that formerly there had been a caravan road starting from this point across the desert, but that, owing to the want of water, it had been abandoned some time ago. The character of the valleys here is pretty much the same as that of those to the south of the main valley, only they are narrower and much lower, and thus the deep indenture of the valley system of the Hadramut gradually fades away into the vast expanse of sand of the central desert of Arabia.

A couple of miles north of Al Had we visited the very interesting site of a ruined Himyaritic town, with traces of buildings of huge stones like those of Al Meshed, and a great rock with a Himyaritic inscription chipped upon it, but unfortunately too shallow for us to make a squeeze. The central word of this inscription appears to me to be *Masabam*, or caravan station, and this spot would be exactly one long stage from Shibam on this road to the desert, which was probably either the great frankincense road itself or an important branch of it. My copy and Mrs. Bent's photograph are now in the hands of Professor Müller, of Vienna, and I hope that when it has been carefully studied it will throw some interesting light on the ancient geography of this part of Arabia. That it was a landmark is obvious, and as the inscription is evidently chiefly a list of names, we may be able to identify some of them as those mentioned by the ancient geographers.

In the Wadi Ser, near to the village of Al Garun, we found a row of very ancient stone monuments situated on slightly elevated ground above the sand. At first I imagined them to have been tombs, but on closer inspection we discovered that the stones, which are large unhewn stones of the dolmen type, are decorated on the inside with geometric patterns, somewhat similar to those found in the Mashonaland ruins, and therefore I feel more inclined to believe that they were originally used for religious purposes. The buildings are about 20 feet square, and several of them are surrounded by circular walls; they are apparently of extreme antiquity, doubtless far anterior to the other Himyaritic remains which we saw in the Hadramut.

At Al Garun the Wadi Ser is entered by a short collateral valley called the Wadi Khonab, in which valley is the tomb of the prophet Saleh, one of the principal sacred places of the district. Kabr Saleh is

equally venerated with the Kabr Hud, also called the tomb of the prophet Eber—for, from what we could gather from the statements of intelligent natives, Eber and Hud are synonymous terms—which tomb is to be found in the Tamimi country further up the main valley. We encamped for the night at Al Garun, and met with considerable opposition from the Beduins and our escort when we proposed to visit the Kabr Saleh next day. However, this was overcome by threats of reporting the opposition to Sultan Sallah on our return to Al Katan. So next morning we started.

A short ride of two hours brought us nearly to the head of the Wadi Khonab, and there, situated just under the cliff, in an open wilderness, is the celebrated tomb. It consists simply of a long uncovered pile of stones, somewhat resembling a potato-pie, with a headstone at either end, and a collection of fossils from the neighbouring mountains arranged along the top. Hard by is a small house where the pilgrims take their coffee, and the house of the Beduin mollah who looks after the tomb is about a quarter of a mile off. Beyond this there is no habitation in sight. A more desolate spot could hardly be found. The tomb is from 30 to 40 feet in length, and one of the legends concerning it is that it never is the same length, sometimes being a few feet shorter, sometimes a few feet longer. The Beduins have endless legends concerning this prophet. He was a huge giant, they said, the father of the prophet Hud, or Eber; he created camels out of the rock, and hence is especially dear to the wandering Bedu; and he still works miracles, for if even unwittingly any one removes a stone from this grave, it exhibits symptoms of life, and gives the possessor much discomfort until it is returned. Once a domed building was erected over the tomb, but the prophet manifested his dislike of being thus enclosed, and it was removed. All our men treated the grave with the greatest respect, and said their prayers around it, barefoot. At the time of the ziara, or pilgrimage, we were told, crowds of Beduins from all the valleys and hills around flock to worship.

When we first got there, we were permitted to approach within a few yards of the tomb, so that we saw it very distinctly; but when, after eating our luncheon, and a siesta under a tree, we again advanced to inspect it, the Beduin mollah attacked us with fierce and opprobrious language, and, fearing to further arouse the fanaticism of these wild people, we speedily mounted our horses and rode away.

These two primitive tombs of their legendary prophets, zealously guarded and venerated by the Beduins, are a peculiar and interesting feature of the Hadramut. We were unable to visit the Kabr Hud, but I am told, on reliable Arab authority, that it is similar in every way to the Kabr Saleh—just a long pile of stones, about 40 feet in length, uncovered, and with its adjacent mosque. It is a curious fact that when one turns to the tenth chapter of Genesis—the best record we have of the

earliest populations of our globe—we find the patriarchal names Salah, Eber, and Hazarmaveth, which name, as I previously stated, corresponds to Hadramut, following one another in their order. I am at a loss to account for these names being still venerated by the Beduins, unless one admits a continuity of legendary history almost too wonderful to contemplate, or else one must consider that they were heathen sites of veneration, which have, under Moslem influence, been endowed with orthodox names. Certain it is that these tombs in the midst of the wilderness are peculiarly the property of the Bedu, and, though visited, and to a certain extent venerated, by the Arabs, they do not attach so much importance to them as they do to the tombs of their own walis, or saints, which are always covered tombs, near or in the centre of the towns. Another curious point I may mention in connection with these tombs is that the Arab historian, Yaqub, in his Mu'gam ii. 100, tells us of a god in Hadramut, called Al Galsad, who was a gigantic man; perhaps this god may have something to say to the giant tombs of Saleh and Eber. Also Makrisi, who wrote in the tenth century A.D., speaks of a giant's grave he saw near Shabwa.

On our return to Al Katan, Sultan Sallah informed us that the negotiations with the hostile Katiri tribe, which he had entered into with the view of our being allowed to pass through their dominions to Kabr Hud and Bir Barhut, a curious volcano or solfatare in a cave near the grave of Hud, had failed, and that the sultans of the Katiri tribe had proclaimed, at the Friday's prayer in the mosque, that they would not admit the infidel; but that the tribes to the east of the Katiri—the Menhali, Tamimi, and Amri—had all sent us cordial invitations. Under these circumstances, Sultan Sallah advised us to return by a devious route to the coast at Sheher, and, if time permitted, to make our journey to the Eastern Hadramut direct from there. This volcano of Bir Barhut should be an extremely interesting spot. Makrisi mentions it as an awe-inspiring volcano in his book, and the Arabs to-day say it is the spot where the souls of unbelievers are sent after death. It is just possible that it may be the *Fons Stygis* of Ptolemy, though, if it is, the position he has given it is erroneous.

On leaving Hadramut, we were handed over to the tender mercies of one Talib the son of Abdullah, the chief of the Jabberi tribe, who inhabit the Wadis Bin Ali and Adim, and also trace their descent from Jabber, a friend and counsellor of Mohammed's. This journey was long and tedious, but afforded us much interest and opportunities of observing the life of the Beduin tribes through which we passed. We found other Himyaritic ruins in the Wadis Bin Ali and Adim. This latter valley, the entire course of which we traversed, has many peculiarities which distinguish it from the other valleys running into the Hadramut. It has in it a running stream called Ghail Omar (and here I may mention that all the running streams, and there are very few of them,

are called Ghail), and is very fertile and full of palm groves. Excellent honey is made in the Wadi Adim, and the Hadramut is celebrated for its honey all over Southern Arabia; it is made from the palm flowers, and has a deliciously scented taste. Pliny alludes to this honey in his sixth book as being, with frankincense and flocks and herds, one of the chief products of this district. Then again the Wadi Adim gradually slopes up to the high plateau, and does not come to an abrupt termination like the other valleys. During the dry season, when there is no water in the tanks on the plateau, all the caravans to the Hadramut pass up this valley; it is far more tortuous than any of the other valleys, and stretches so far down towards the coast that the traveller has but little of the plateau to cross before descending to the sea, and seems to be the natural drain of this high plateau.

Owing to the fact, of which we were previously ignorant, that the Jabberi were at war with the Hamumi, who dwell in the narrower defiles of the Wadi Adim, we were exposed for some time to considerable difficulties and danger on this road, but eventually, with the loss of a little money paid in black mail, and having been fired at on four different occasions, we safely reached Sheher at the beginning of March. As a rule I consider travelling in Arabia, though arduous and productive of endless worries, is on the whole safe. Before entering the territory of a tribe you must have a *sayyir*, or guide, from that tribe, and when you have paid the *sayyira*, or toll money, you may travel with safety. Dangers in Arabian travel have generally arisen from travellers entering tribes without the *sayyir*, and though we were menaced, and on more than one occasion frightened for our lives, we never lost a thing during our whole journey. Sultan Houssein Al Kaiti, of Sheher, willingly engaged to send us with a sufficient escort to Bis Barhut and the Eastern Hadramut, but the season was too advanced and our resources too low to permit us of again penetrating into the interior. So we contented ourselves with making an expedition along the coast towards Saihut, which was chiefly of interest from a geographical point of view, enabling us to determine the course of the Hadramut to its outlet, and the configuration of the plateau, whilst we reserved further explorations in the interior for another season.

In conclusion, I wish publicly to tender my thanks to Imam Sharif Khan Bahadur, who accompanied us as surveyor from the Indian Government, and who worked assiduously at his map and observations during the journey, for his great assistance throughout the whole of our expedition. Owing to the distinct opposition to our expedition which was manifested by our own Government at Aden, we should have found it difficult to do even what we did do without Imam Sharif, who could in Hindustani freely converse with those of the natives who had lived in India; and I am further convinced that if our own Government had given us a more willing support, we might have been easily able to

accomplish much more. As it is, thanks to Imam Sharif, we are now able to constitute a survey of a little-known district to the geographical world. Also Wm. Lunt, who accompanied us as botanist from Kew, with a grant from the Royal Society, worked indefatigably at his collections, which are now in the hands of Mr. Thiselton Dyer; and Mahmoud, the Egyptian naturalist, who was sent out by the British Museum, has, I am told, made a very satisfactory collection of reptiles, a complete set of which will be presented to the Museum.

The PRESIDENT made the following remarks before the reading of the paper:—

I am sure the meeting will cordially welcome the return amongst us of Mr. and Mrs. Theodore Bent. It seems so short a time since they were here and since we bade them farewell, that it is difficult to believe they have gone through so many adventures, hardships, and perils, and have explored an almost unknown country to Europeans in the interval. I regret to say they have met with very serious and very wanton official obstruction at Aden, which very much increased their difficulties and also the danger of their undertaking. I will not detain you any longer, but will now request Mr. Bent to read us his communication.

After the reading of the paper the following discussion took place:—

Mr. THISELTON DYER: I cannot imagine that the Royal Geographical Society can often have listened to a more fascinating narrative of travel than that which has been laid before us to-night by Mr. Theodore Bent, and I think we must all have felt an agreeable kind of disillusion on hearing the account of what he had actually seen compared with what we thought before he started he might have to endure. I certainly for my part did not suppose that we should get such a glimpse as we have had of Oriental civilization as it seems to exist, with magnificent palaces and splendour, in the Hadramut valley. With regard to my interest in the result of Mr. Bent's journey, I shall not trouble you with more than a very few words. Of course, the geographer has to consider the world's surface from the point of view of its physical features and political divisions. The botanist, on the other hand, simply studies the vegetable productions of the soil and their relations in any one case to those of other areas which he has examined. I shall perhaps surprise you when I tell you that although undoubtedly in the geographical, and to a certain extent political, sense, Arabia belongs to Asia, yet if you study the vegetation, it is equally undoubtedly a part of Africa. It is a very extraordinary thing, and one which the scientific botanist has always felt some despair about, that, although Arabia confronts us at every point of the world's history, it is the one part of the world of which I may say at present we really, as far as natural history is concerned, know least. And even at the present time, although some amount of information has been obtained, it is almost entirely derived from the south-west corner, the province of Yemen. The botanical history of Arabia can be told almost in four words, beyond the little we read in the Bible about the myrrh and frankincense which former Phœnician commerce carried up the Red Sea and introduced into the Mediterranean. From that time until the end of the last century, we knew practically nothing more about the vegetable productions of this great peninsula. At that date an intrepid Dane, Forskal, spent some time in exploring the province of Yemen. He did admirable work, but unhappily left his bones in the country with which his name will ever be associated as the first botanical explorer. A hundred years later, Defiers, a Frenchman who had lived in Egypt, fired with enthusiasm to continue the work of Forskal, made an

admirable collection; and that distinguished traveller so well known in this Society, Schweinfurth, also more recently visited the same country.* But you will see that these latter journeys were made upon the same portion of Arabia, and practically completed what Forskal had done. I should not forget that our own Indian officials have carefully examined the peculiar but very limited flora round Aden (from which about 200 species are known); but Mr. Bent is absolutely the first person who has brought us any information as to the remarkable productions of the valley he has described to-night. Now, as you have had your imagination stirred with a glimpse of one of the most mysterious aspects of Oriental life which, since the 'Arabian Nights,' has ever been brought before an audience, I can scarcely expect you to listen to details interesting to the botanist. But what Mr. Bent has found out amply confirms the deductions made from preceding researches. The fact is that the vegetation of Arabia is practically that of Somali Land and Abyssinia, with the same myrrh and frankincense trees in one country as in the other. I ought not to have forgotten that Professor Bailey Balfour laid before the Society an account of an expedition he made to the remarkable island of Socotra. We had hoped that Mr. Bent would have found some extension on the mainland of the remarkable plants found on that island, but that expectation is to a certain extent disappointed. Mr. Bent, however, found a dragon tree, nearly allied to that which exists in Socotra, which is the source of the cinnabar of the ancients, the red colouring matter called dragon's blood in modern times. I have not as yet a detailed account of the scientific work of the collector whom Mr. Bent was so kind as to allow to accompany him from Kew, but it will be published in due course. I do not know that I should be justified in detaining you any longer by going into details. Surgeon-Major Carter was the first man to make a careful study of the distribution of the frankincense tree about which we have heard so much to-night. It is a curious fact that there appear to be two districts in Southern Arabia, one to the south-west producing myrrh, and the other more towards the Oman country producing frankincense. As far as I can make out, and from what Mr. Bent has told me in conversation, the route taken must have been on the boundary-line of the two districts. Upon the exact marking out of these two districts, I believe some extremely interesting points in ancient commercial history will be found to depend, and when we have discussed the material brought back by the expedition, we shall, I hope, be able to add a chapter not uninteresting in itself to the supremely interesting work of the expedition.

The PRESIDENT: It remains for me to express your thanks to Mr. Theodore Bent for his admirable paper and his sketches, and to Mrs. Theodore Bent for her photographs, which together have given us a very clear idea of the country which was almost, if not quite, unknown to us. I have several times looked over the work of Halévy, and never been able to get any clear idea of the country from him. Of course, we have already the journey of General Miles, and my dear old friend Munzinger, afterwards murdered by the Gallas on the other side of the Red Sea, but their route was considerably to the westward and nearer the coast than that penetrated by Mr. and Mrs. Theodore Bent. You will all agree that they have done their work in a most admirable way, and brought back to us descriptions of a most romantic country of which we have only before heard rumours, and I hope you will allow me, and I am sure they will be glad, if I couple with them the name of the native surveyor from India, Imam Sharif, for the geographical work he did, above all for his great usefulness and helpfulness to Mr. and Mrs. Theodore Bent,

* Schweinfurth estimated the known plants of Yemen at 1500, of which three-fourths are also common to Abyssinia. He himself collected half of the species in the Italian colony of Eritrea, which he had previously collected in Arabia.

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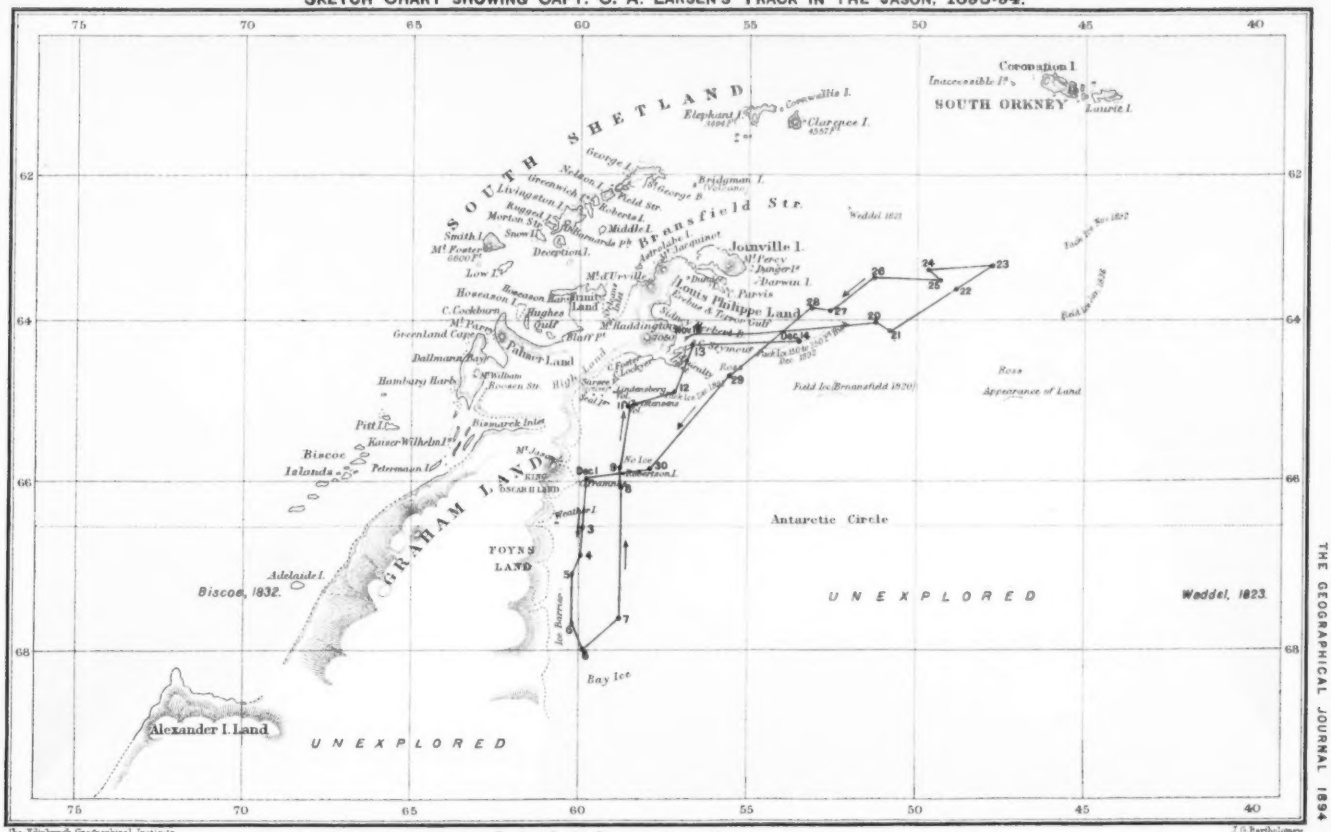
SKETCH CHART SHOWING CAPT. C. A. LARSEN'S TRACK IN THE JASON, 1893-94.



The Edinburgh Geographical Institute

J. G. Bartholomew

in the absence of official help, which they had a right to expect from Aden, most improperly withheld from them. It is very much to Imam Sharif they owe not only what they have done, but their safety. I beg Mr. and Mrs. Theodore Bent will accept the very grateful thanks of this meeting for their admirable paper they have communicated to us.

MAP OF HADRAMUT.—The positions of many important places on this map, such as Mokalla, Hajarein, Shiham, and Sheher, were fixed by astronomical observations taken with a theodolite. The survey was made with a plane-table and prismatic compass, and the heights determined with an aneroid.

THE VOYAGE OF THE "JASON" TO THE ANTARCTIC REGIONS.

Abstract of Journal kept by Capt. C. A. LARSEN.

ON *Friday, November* 17 (1893), we had a gale from N.W., veering in the evening to W., and moderating. The sea was very high. The ship was kept under sail all day. No ice was seen in the places where we had been hunting seals before. The water was quite clear in the E. and towards Graham's Land, but the ice-fields seem to lie in the same place where we saw them during our last cruise. Position at midday, 64° 24′ S. lat., 55° 14′ W. long. Barometer, 743 mm.*

Saturday, November 18.—To-day a breeze with clear sky and sunshine. At 6 a.m. we began to steam W.N.W. and N.W., and caught ten seals (*Fiskesel*). At 5.30 p.m. we lowered two boats and went ashore on Cape Seymour. We landed about the middle part of the island. The second mate was sent with one boat to a little bay for reconnoitring; and the first mate with two men went in another direction inland; while I, with two other men, went in a third direction.

The land is hilly and intersected by deep valleys. Some of the hills are conical, and consist of sand, small gravel, and cement; here and there is some petrified wood. Upon the hilltops we occasionally found eggs of sea-birds.

We saw here a species of land-bird, belonging to the Rapaces, which resembles our hawk; it occasionally came down and pecked some eggs. When we were a quarter of a Norwegian mile from shore, and stood about 300 feet above the sea, the petrified wood became more and more frequent, and we took several specimens, which looked as if they were of deciduous trees; the bark and branches, as also the year-rings, were seen in the logs, which lay slantingly in the soil. The wood seemed not to have been thrown out of water; on the contrary, it could have never been in water, because, in the first case, we found petrified worms, while there were none in the second. At other places we saw balls made of sand and cement resting upon pillars composed of the same constituents. We

* The ship's journal gives 74·3, which evidently means 743 mm.—TRANS. NOTE.

collected some fifty of them, and they had the appearance of having been made by man's hand.

In one of the valleys we saw many dead seals, one of which was also almost petrified, while others seemed to have come only recently here; and there were corpses in which the fat still contained some streaks of blood.

We came to a spot where innumerable penguins had their resting-place. Their nests consisted of small shingle and birds' bones, of which there must be large quantities; occasionally eggs were lying in the open, but usually in nests, each of which contained two, or at the most three eggs. These eggs could be eaten baked, but not boiled, because the white would not harden; they were not very palatable.

We took with us samples of forest wood, some crystals and cemented stones. We also proposed to visit the spot where we had been during our first tour, but could not do so on account of darkness setting in when we were still several miles from it.

It seemed as if the island was of volcanic structure, because there was no snow either on the hills or in the valleys. The beach is flat, and consists of white sand.

On the eastern side of the island we found what appeared to be traces of a recent eruption. The land, elsewhere of a brown colour, was here black; and the surface and landward sides of the ice-field, which here lie probably on the ground, were also extremely dark.

"Joinville" may be considered as the opposite of "Seymour," because it, as well as the land in the west of Cape Seymour, which lies a couple of English miles off, in the Admiralty Inlet, is nearly all snow-covered.

In the S.W., Cockburn Island is all snow-covered, both the hills and the depressions, with the exception of a small bit of land in the S.E., which is probably a continuation of Cape Seymour—the inlet being hardly 2 or 3 fathoms deep. This space is covered with snow and ice, and is identical in structure with Cape Seymour.

The contrast at sunset, when the dark, naked land was thrown out against the snow-covered background, rising gradually to the summit of Mount Haddington at a height of 7050 feet, was very striking.

It was already night when we returned on board, and we set our course to the N.N.E., with the hope of finding seals to the N. of Danger Island. Barometer in the evening 744 mm.

Sunday, November 19.—Breeze from W.N.W. At night we steered N. by E., which course was maintained till 10 a.m., when we fell off to E. by N., and proceeded 10 miles (Norwegian) further. At midday we sighted Paulet Island. Only field ice was seen between here and Cape Seymour. We resolved to explore the ice in the east of this spot, where we had fished last year. Position at midday, 63° 48′ S. lat., 55° 10′ W. long., according to bearings to Paulet Island. Barometer, 739 mm. in the evening.

Monday, November 20.—Breeze from W.N.W. and N.W. Course changed at 10 o'clock to S. by E. We found ice just after midday, and sailed into a little bay, which we worked through, looking for seals; but not many were seen, and we caught only a few (*Graasel*). The ice was hard at its edge, but soft in several places in the bay. The ship was brought-to in a place cleared of soft ice. We were, at midday, in 64° 7′ S. lat., 51° 5′ W. long. The barometer predicted storms. Off the ice-rim the sea was high.

Tuesday, November 21.—Light breeze from W.S.W. At 4 o'clock in the morning we began to work towards the S. and S.S.E. till 9 a.m., when we turned towards N.N.E. and N.E. Some spouts of whales were seen amidst the floating ice. We have caught few seals, and the outlook is poor for hunting. At 4 p.m. we stood clear of the ice, and kept along its margin north-eastwards until 8 p.m., when we sailed into a little bay and stopped for the night. We were, at midday, in 64° 21′ S. lat., 50° 59′ W. long. Barometer in the evening, 745 mm.

Wednesday, November 22.—Breeze from the W.N.W. increased to a storm from the S.S.W. in the evening, with snow and great cold. At 4 a.m. we began sailing N.N.E. along the ice-margin till 5.30 p.m., when we brought the ship into a small bay, where we lay for the night. We saw a number of blue whales (*Blaathvalen*) and grampus along the ice-margin. The ice is very hard packed here on account of the winds from the W. which have blown these last days with a heavy sea against the ice; so nothing can be expected before the wind changes to the S. or S.S.E., which wind will carry the ice away from the places which are good fishing-grounds. We found last year that those grounds were rich in seals where there were plenty of small fishes and shrimps, and in these places we then met with a large quantity of that kind of food. We were, at midday, in 63° 41′ S. lat., 48° 52′ W. long. Barometer, 751 mm.

Thursday, November 23.—Breeze, with snow and fog, from S.W., which continued till after midday. We worked into the ice, but as it was very packed, and no seals were to be seen, we came out and set sail, steering N. from 6 till 10 p.m., when we sailed W.S.W. Position at midday, 63° 22′ S. lat., 47° 32′ W. long. Barometer, 755 mm.

Friday, November 24.—Wind from W.N.W. and W.S.W., with snow and fog. Sailed westwards till 6 p.m., when we took a N.W. course. Nothing to report, in consequence of snow and fog. Position at midday, 63° 29′ S. lat., 49° 37′ W. long. Barometer, 753 mm.

Saturday, November 25.—Fresh wind from S.W. till midday. We went S.S.E. till 1 p.m., when we took in sail and steamed westwards along the ice-margin. The ice lies as before, so there is nothing to expect. We saw hardly any seals. In the evening there was a light breeze from the N.; so we made all sail westwards along the ice-margin. Position at midday, 63° 35′ S. lat., 49° 20′ W. long. Barometer in the evening, 751 mm.; fog.

Sunday, November 26.—Breeze from W. and W.N.W., with fog. The ship was several times under sail. We saw some whales (*Finhwale*) and birds. Very heavy sea, and we have passed by many ice-fields. Position at midday, 63° 22′ S. lat., 51° 18′ W. long. Barometer, 750 mm.

Monday, November 27.—The wind has changed to N. and N.E., light in force, and a thick fog is lying. We were within a bay made by an ice promontory, and came out of it at 7 o'clock (after having taken a sea-leopard), because the ice here also was thickly packed to its margin. We have had a boat out for hunting a whale (*Knarhval*), but lost sight of it on account of the thick fog. It appeared, however, that there was abundant food for the seals, and many whales and sea-birds were seen. At midday we were in 63° 59′ S. lat., 52° 32′ W. long. Barometer in the evening, 753 mm.

Tuesday, November 29.—Breeze from the N. and N.W., with very thick fog. We sailed towards the S.W. till 4 o'clock, after which we sailed close-hauled on the starboard tack. In the evening the fog partly cleared. Many ice-fields were passed to-day; the ice is in parts quite packed, and was drifting eastwards. Position at midday, 63° 56′ S. lat., 53° 8′ W. long. Barometer, 751 mm.

Wednesday, November 29.—We had to-day a fresh breeze from the W., and sailed close-hauled. A number of ice-fields were passed, from 200 to 250 feet high, and sometimes 10 English miles long, but scarcely any small ice was to be seen. At 5 o'clock we passed an ice-ledge, upon which there were seals, while some whales (*Finhvale*) were swimming round it. At 6 o'clock we had cleared the big ice-fields, and saw open water towards the S. as far as the eye could see from the masthead. We have been all the day long in sight of Graham's Land, and had fine weather.

As we had thus explored the ice E. and W., and found that there was nothing to expect so long as the ice should remain in the same condition, we thought it would be best to push southwards close to the land, in the hope of finding whales (*Rethvalen*), as there was so much open water behind the ice-fields. At midday we were in 64° 50′ S. lat., 55° 33′ W. long. Barometer, 751 mm. in the evening; fine weather.

Thursday, November 30.—Wind changing from N.W. to N. and E., with light breezes, fine weather, sunshine, and much warmth. We steered S.W. till 1 o'clock, then W.S.W., passing very few ice-fields on the way, and no small ice of any importance. At 10 p.m. we saw through the fog a dark mass, which we supposed to be the land, and also here and there in the water some seals. Hove-to for the night. Position at midday, 65° 57′ S. lat., 58° 0′ W. long. Barometer, 741 mm., slightly falling, in the evening.

Friday, December 1.—Fresh S. wind, with some snow and fog. At 4 a.m. we turned the ship off the ice, and heard at the same time the spout of a whale, but on account of the fog I could not say what whale

it was. At 6 o'clock it finally cleared, and we lowered our boats, six in number, which were sent to a low ice-rim in a small land bay, where great numbers of seals were lying. However, most of them were far on the ice, which was covered with deep snow, so that the boats could only catch the seals along the borders; they, however, killed one hundred and twenty-five (*Fiskesel*), very big and fat. The land which we saw to the W. and S. of us was named King Oscar II.'s Land. It appeared to be a high land covered with snow and ice, stretching southwards and northwards, with many high snow-covered peaks in the interior. Here and there it was free of snow, and showed its grey slopes. Looking from the sea, it appeared most interesting for scientific exploration, as there were immense glaciers, which reached nearly to the sea, and I suppose that it would be easy to climb over them, with snow-shoes. The first mate and myself walked over towards them. How interesting it would have been to explore that land! but, as we were not sent out for scientific exploration, but for whale and seal hunting, we had to resist the temptation. We gave the name of Mount Jason to a high peak which rose in the east of that highland; and to the promontory which shoots off in an eastern direction from Mount Jason, we gave the name of Cape Framnes. It appeared, in fact, to be the most advanced point of the land which we saw here.

Mount Jason is very free of snow in its lower parts. The land to the N. of it seemed to be more even, with gently rising fjeld-ridges. Round Mount Jason and Cape Framnes, on the contrary, it is very uneven and broken by ravines. A fjord, filled with ice, runs inland, to the N. of Cape Framnes, in a westerly direction. A high barrier of ice stretches from the fjord northwards and slightly eastwards. This barrier is very high in some places, and seemed to stretch from the fjelds towards the sea, apparently covering also the lowland, since it protruded for 5 or 6 English miles into the sea. The ship was about 3 English miles E. off the nearest shore of Cape Framnes.

So far as we could see, the mainland runs somewhat W. of N. (N.N.W.) to E. of S. (S.S.E.), and has many indentations; to W.S.W. of us, it had a very high mountain, whose slopes were mostly snow-clad.

We saw here five or six species of sea-birds. The current is flowing N.N.E., at a speed of 1 mile. We have had remarkably fine weather and light winds. Position at midday, 66° 4′ S. lat, 59° 49′ W. long. Barometer in the evening, 743, rising.

Saturday, December 2.—Light breeze from N.W. to N.E. all day, with clear atmosphere, fine weather, and sunshine. We steamed northwards along the ice-barrier, looking for an opening inwards into the land; but so far as I could see from the masthead, the ice-barrier stretched straight along the coast; so we returned to the ground of the previous day, and caught ninety seals. There was a great number of seals on

the solid ice, and we sent a party to see whether it would be worth catching them on the ice, and dragging them to the boats; but this proved to be impossible, on account of the deep snow, into which the men fell. The ice also was very insecure in many places, as it was rotting from beneath by the current, and from above by the salt.

In the evening we saw in the water some small fishes with big eyes and a bright skin; also a lot of birds. At 8 p.m. we began cruising along the barrier, and saw several small whales which we supposed to be *Minkeval;* they moved southwards. Barometer, 747 mm.

Sunday, December 3.—Light breeze from N.E., with haze. We kept sailing all night along the ice-barrier, first S.E. and then S. The barrier proved to be here much higher than in the N. of Cape Framnes, and there were deep indenting fjords, partly covered with thin ice, upon which seals were lying in great numbers. The ice-cliffs were here overhanging and crevassed, and immense blocks fell from them into the sea with deafening noise, so that great caution had to be exercised not to approach too near the barrier. We caught a few seals (*Graasel* and *Fiskesel*) which were lying upon the lower ice; they were very fat. Behind the ice-barrier the land appears even and snow-clad; it stretches in a southern direction. There must be ground under the ice-barrier, because in some places it stretches far into the sea. We caught to-day ninety-six seals. Position at midday, 66° 42′ S. lat., 59° 59′ W. long. Barometer in the evening, 749 mm.

Monday, December 4.—Breeze from the N.E., with mist. We lay off the ice-barrier under sail, and saw many seals, but could not go on hunting, as the sea was too high. Round the spot where we are now there are many long fjords, stretching through the ice-barrier; we could not see their heads. Some of them are very wide at their mouths; inside they are covered with small ice. The ice-cliffs on both sides of these fjords were much overhanging, so that if there were seals we could not have tried to catch them. The emperor penguins (*Kongepenguinerne*) were very numerous in those fjords. Position at midday, 67° 0′ S. lat., 60° 0′ W. long. Barometer, 747 mm.

Tuesday, December 5.—Since yesterday we have had a N.E. breeze until 4 a.m., when the wind fell, and it began to snow. We steamed southwards. At 12.30 we saw a whale spout, but could not ascertain the species. At 2.30 the mate saw three more spouts, and he could only ascertain that one was from a *Rethval;* he took a boat and rowed to the spot, but did not see the whale again, although he remained out for two hours. At 8.30 another spout was seen, but too far from us. We sailed along the ice-barrier. Position at midday, 67° 13′ S. lat., 60° 16′ W. long. Barometer, 746 mm.

Wednesday, December 6.—Light breeze from the W. with snow till 11 a.m., when it cleared. We began to steam along the ice-barrier, first S.E. to E. till 1 o'clock, when, the barrier going more to the S.,

we steered S.S.E. and S. by E. till 6 p.m. Our southward progress along the coast was then stopped by winter ice, which in some places was frozen hard together, and broken by crevasses, with smaller ice-fields lying between. These were very uneven, and looked as if they had been pressed during the winter by the drift of ice against the barrier. Bay-ice stretched north-eastwards towards a promontory.

Our most southern spot was reached this afternoon at 6 o'clock, in 68° 10′ S. lat. To the westward land seemed to rise quite evenly from the sea, to a considerable height, and, so far as I could see from the masthead, it stretched further S., with bay-ice and occasional ice-fields along its coast. From the ice-barrier, which stretches along the land from S. to N., originate most of the flat ice-fields, which drift to the eastwards of spaces on the E. of Graham's Land and Danger Islands, as also between the Shetland and the Orkney Islands, approaching nearer to the latter on account of the currents.

The weather here, in the S., was much better, with less cold, fog, and snow than it was further N. We saw some gulls and penguins.

Position of ship at midday, 67° 50′ S. lat., 59° 59′ W. long. Barometer in the evening, 748 mm.

Thursday, December 7.—Fresh breeze from N.E. We have followed the eastern side of the barrier since yesterday evening. The ice stretches N.N.E. and more to the E. At 5 p.m. we saw an ice-promontory in the N.N.W., and cleared it at 7.30, because it turned towards the E. If we had kept longer in the bay, and if the wind had begun to blow from the E., we should have run the risk of being frozen in, as the ice-promontory would have turned and been pressed against the ice-barrier.

The weather was colder to-day, with some snow. We passed by several ice-fields. At the low ice-promontory we saw numbers of gulls in the water. They were of the same species as those of the Arctic Ocean, named *Graamaage*, or Havhest. Position at midday, 67° 45′ S. lat., 58° 56′ W. long. Barometer, 749 mm.

Friday, December 8.—Gentle breeze from the N.E., with a thick fog. We steered N.N.W. All sails set at 2 a.m., and the engines were stopped, as the fog was very thick. At 2 p.m. we began going N.E. to look for seals near the land, where we had previously hunted them. We began cruising at 7 p.m., as a strong breeze came from the N.E., and the sea was high, even near to the ice-barrier. Position at midday, 66° 12′ S. lat., 58° 46′ W. long. Barometer, 738 mm.; fog and rain.

Saturday, December 9.—Wind in the morning, falling to a light breeze from N.E. We made towards the ice, under steam, and, when we came to the ice-rim, we saw a few seals, but we could lower no boats on account of the heavy sea. The high mainland was now seen distinctly. An island was well seen to the W.S.W. of Cape Framnes, and we named it Weather Island (*Veier Öen*); it lies a good deal off the land

On the mainland, S.W. from Weather Island, are four hills, which are free of snow on their northern and eastern slopes. These heights were named by us Foyn's Land. From their N.W. end, near to an indentation of the coast, begins a ridge, which stretches north-eastwards till it meets with the lowland near Mount Jason.

Foyn's Land is a very conspicuous landmark, especially when approached from the N. along the edge of the ice. The sides and summits of the four hills can then be seen as they slope gently southwards from the ridge to the snow-covered ground.

We went northwards along the ice-barrier under steam against a light breeze from N., and under all sail when the wind came from the S.E.; the weather bright and sunny. An immense number of birds, of large and small size, were sitting on the ice-cliffs. The ice-barrier trends here very evenly northwards, with small bays here and there. Towards the evening we passed an island which was very free from ice and snow, and we named it Robertson Island. It stretches from S. to N., and halfway trends N.W. It has its highest part in the S., while at its northern extremity the land is low, and it was mostly free of snow. It was possible to approach pretty close to it, the more so as there was a bay in the ice which descended to the beach. We saw here a blue whale (*Blaahval*); but after hunting it for some time, we lost it. Position at midday, 65° 57′ S. lat., 58° 53′ W. long. Barometer in the evening, 733 mm.

Sunday, December 10.—Breeze with snow and thick fog all day. We cruised up and down along Robertson Island and to the edge of the barrier. The ship drifted close to the ice-rim of the island, so that we could make headway even against the wind, till 2 p.m., when the current drove us towards the land. We kept about 3 miles off the island, where there were drifting ice-fields. The wind abated towards the evening, but the sea was pretty high. The current has here a speed of about 2 miles in a N.W. direction. Position at midday, 65° 18′ S. lat., 58° 20′ W. long. Barometer, 738 mm., rising.

Monday, December 11.—Wind turning from N.E. to S. and S.W., with snow and occasionally clear weather. We steered towards a little volcanic island, situated to N.W. of Robertson Island. It was in full activity. We named it Christensen Volcano. A small sound running W.N.W., which is quite narrow in the middle part of Christensen Island, and again widens on the other side, separates it from Robertson Island. We landed with three boats on the ice-rim of Christensen Island. The first mate and myself went on the ice, which was 5 to 6 feet high, but much lower in places. The rest of the crew had to begin later on catching seals. We put on our snow-shoes and went inland. From the masthead of the ship I had seen a large herd of seals which extended from Robertson Island along the whole length of Christensen Island, lying near to the margin of the ice, in a great

curve, as far as a small volcanic island situated N.W. of Christensen island. This volcano had the shape of a sugar-loaf and was of considerable height. The ice was melted for a considerable distance around it. It presented a remarkable aspect, as round the top and on the slopes there were funnel-like holes, from which a very black and thick smoke issued from time to time, covering the top itself. In short, it was in full activity.

We went on Christensen Island a distance of about 4 English miles from the ice-rim; but the route was hard, as we had to work through a deep and wet snow which went into our snow-shoes, and we also had to take a circular route in order to avoid places where there was much water, sometimes forming large streams. When we were nearly halfway to the middle of the island, we found an obstacle in a crevasse nearly 10 feet wide, which we had to follow till we saw a snow bridge which crossed it, leaving a rent nearly half a fathom wide near to its other side. As the first mate was anxious to approach the herd of seals, we crossed it, not without some difficulty, and directed our steps to the densest part of the herd of seals. On the way, we found, at a distance of about 1 English mile, a great number of volcanic stones, which must have been thrown out recently. The ice becoming harder, and very uneven—since it had melted away in places after the volcanic eruption —we took our snow-shoes off. The seals lay in places so closely packed that we had to make circles in order to advance. It was a delightful sight to see those masses of animals, most of which proved to be youngsters of the *Fiskesel*, which already had changed hair; they were beautifully fed, and looked like so many balls. Here and there an old animal was amidst the youngsters. The seals were not a bit afraid of us; on the contrary, they stretched their flippers towards us as we pelted them. There were many openings in the ice, due to the current which runs towards the land, and to the heating of water by all these volcanic eruptions.

There must have been here abundant food for the seals, as the ice was everywhere strewn with fishes and fish-bones. When I opened the stomachs of the seals, I saw them filled with a fish which has a white flesh, and which we call at home *Kvitting* (whiting), and also with sharp bones.

As these seals were lying too far from the water, and the snow was too deep for the men to work, we left them untouched.

Christensen Island was mostly free of snow, of which there is only a little on the N.W. and S. sides; in the middle part, and all along the way to the top, there was no snow whatever. About the middle of the eastern side of the island there is a mass of stone *débris*, which extends from the beach to the middle of the island. The slopes of the island are pretty steep in this place, but gentle towards its ends.

On our return journey we found the snow bridge in the same state

as before, and we reached our boats without further adventures, only very fatigued, as snow had fallen while we were in the middle of the island. The crew had caught twenty-eight seals.

To W. by N. from Christensen Volcano there are—in a straight line, so far as we could see—five islands, which we named Seal Islands (*Sel Öerne*). The one which lies most to the S.E. is very high, and has its highest spot on its S.E. end; the second island is quite low, and has no spot which would attract attention; the third is high again, and has its summit to the east of its centre; the fourth is also high, and has its highest spot on the eastern end, while its length attains nearly 3 Norwegian miles. The channel between the third and the fourth islands is nearly twice as wide as between the second and the third. The distance between the fourth and the fifth is greater than this last, and it turns a little more to the N.W. than the first-named sound. The fifth island of the group is also much lower than the fourth, and has no prominent features. All these islands are free from snow, so that they are probably of volcanic origin, the more so as all tops of mountains on the mainland are snow-clad.

The ice between all these islands is flat and low. In the W. of Cape Foster, and also off this range of islands, the ice is quite low, and, so far as I could see in fine weather, there is no land to be detected to the N. and N.E. of Lindenberg Volcano. I saw several elevations amid the ice, which I think must be low rocky islands (*Skjær*), not high enough to rise above the ice; they are either quite flat, or may rise some 5 feet above the surface of the water. These rocks do not extend more than 3 to 4 English miles to the N.E. from Lindenberg Volcano.

In the evening of the same day, after we had steered N.N.E. and E.N.E., we sighted Cape Foster. Position at midday, 65° 7′ S. lat., 58° 20′ E. long. Barometer in the evening, 744 mm.

The approximate positions of these islands, measured relatively to the middle point of Weather Island (*Veier Öen*), which lies in 66° 26′ S. lat., 60° 45′ W. long., is as follows:—

Top of Mount Jason	65° 44′ S. ...	60° 45′ W.
Northern extremity of Foyn's Land	66° 42′ ...	61° 50′
S. Point of Cape Framnes	66° 5′ ...	60° 37′
N. and E. point of same	65° 43′ (?) ...	56° 57′ (?)
Highest top of Robertson Island	65° 50′ ...	58° 47′
Christensen Volcano, highest spot	65° 5′ ...	58° 40′
Middle of Lindenberg's sugar-top	64° 50′ ...	59° 0′
The South-eastern Seal Island, highest spot ...	65° 5′ ...	59° 11′
Seal island, No. 2, middle	65° 1′ ...	59° 23′
„ No. 3, „	64° 59′ ...	69° 34′
„ No. 4, „	64° 53′ ...	59° 52′
„ No. 5, „	64° 45′ ...	60° 8′

All these are given according to the ship's dead reckoning, as accurately as possible.

The journey was continued therefrom till December 16, when Danger

Islands were passed, as well as Joinville, where we saw a rock or cliff, about 30 feet high, whose position was ascertained with an altitude and by means of bearings on the land to be as follows: 63° 5′ S. lat., 55° 18′ W. long., 15 English miles from Joinville. On the north side of the same there are also several reefs, showing above water for about 2 English miles from shore.

From here we continued the voyage between Graham and Shetland Islands to Middle Island. The fog being too thick to continue westwards, we decided to abandon our idea of entering the Shetlands archipelago. In the fog we touched land on the southern extremity of Greenwich Island. We therefore made the narrow strait between Greenwich and Livingstone islands. I have been inland as far as the middle of the former island, which was mostly covered with snow; but in the middle of its southern end, where it was flat, there was in places no snow, and the soil was covered with moss; a few seals were seen on the beach. There is here a promontory, which runs southwards, etc. The north part of the island, which attains a height of about 100 feet at its edge, is covered with snow. At the north end a row of rocks stretch in a north-westerly direction to about the middle of the channel; the navigable passage in the eastern part is quite narrow, with sunken rocks on both sides.

We kept the high steep islands on our starboard, and found a few rocks (*Skjær*) at the mouth of the channel; then we kept the next island to port, as there was no passage to the W. of it. We kept next under a little vertical rock which rises like a pillar from the sea, leaving it to starboard. To N.W. we saw an island, rising vertically from the water on all sides except the southern, where it slopes more gradually. It attains a height of 1600 feet, and looks like an augitic stone, flat on the top, and covered with moss.

All the rocks and small islands were kept on starboard except one group of one larger island and five small ones, which we had on our port side. On keeping exactly in the midst of the described water, one gets clear of all of them. Once the high cliff just mentioned is passed, the water is free. It must be remarked that on the map few only of these islands are marked. We gave the above inlet the name of Norway Sound (*Norske Sund*).

On Livingstone Island there are many good beaches and bays. The stone pillars seem as if they had been made by man's hand, and rise high upon the cliffs near the beach.

From here the journey was continued without any hindrance. We went to the coasts of Chili, to see if we could not find some whales, but as we saw none, we went to Port Stanley, to get rid of the seals we had captured, and take coal for a new journey southwards.

We passed then between Clarents Island and Elephant Island towards Joinville, passing off the inside of these islands, and taking the

direction of Mount Percy. The most northern of the Danger Islands nearest to Joinville lies more southwards than is shown on the map, as it is very little north of the line of the other islands.

We then proceeded to Paulet Island, which appears to be marked correctly on the old map, and passed between this island and Cape Purvis. There are shoals a little off Paulet Island, so that ships with deep draught cannot approach it from the N. side. Paulet Island was once an active volcano. It was quite clear of snow, and had, a little way from the top, a terrace upon which thousands of penguins were sitting; large spaces underneath the terrace and northwards were also without snow, as well as a beach which attained a great width, and had a little lake upon it. All this flat part was covered with penguins, and many seals, which we hunted, were also lying on the sandy beach. The northern side of the island has a striking appearance, on account of its steep red cliffs, which rise from the water, and are seen from a great distance, the red showing very well on the grey background which formed the rest of the island as we saw it on January 23, 1894.

From there we went into Erebus and Terror Gulf, where we found some drift-ice, and hunted for seals for two days. On January 26 we sailed eastwards almost in the line of continuation of Danger Islands, where we found ice in almost the same position as in 1892. Here we continued hunting, and drifting in a northern direction towards Joinville. On March 8 we lowered the boats for the last time, in 64° 27′ S. lat., 53° 55′ W. long. On March 10 we encountered a raging storm, with great cold and thick snowfall, so that the ship was quite covered with ice.

We reached Falkland on March 15.

PHYSICAL CONDITIONS OF THE CLYDE SEA AREA.

By HUGH ROBERT MILL, D.Sc., F.R.S.E.

The name "Clyde Sea Area" is applied to the waters of the south-west of Scotland, loosely known as the Firth and Lochs of the Clyde, lying between 55° 5′ and 56° 17′ N. latitude, and between 4° 30′ and 5° 40′ W. longitude. This connected water-area lying to the north of a line drawn from the Mull of Cantyre to the Rinns of Galloway measures 1160 square miles, and has an average depth of 29 fathoms, the total volume of water in it at low tide being 25·54 cubic sea-miles, with an addition of 1·15 cubic sea-miles at high tide. The Clyde Sea Area is a distinct natural region, although on the surface it is continuous with the Irish Channel. This channel communicates freely with the Atlantic, north of Ireland, the average depth being greater than 60 fathoms; but across the entrance to the Clyde Sea Area there is a broad expanse of very shallow water covering a shoal known as the Great Plateau, the depth over the shallowest part of which is only 21 fathoms. Ailsa Craig, a small islet of volcanic rock, rises from the crest of this plateau, and the northern edge of the plateau reaches to the large island of Arran. The bed of the

Sea Area north of the plateau sinks into two depressions, one running along either side of Arran; these unite at the north of that island, and the deep water terminates near Ardrishaig. This region I term the Arran Basin. At its northern extremity it is prolonged north-eastwards in Loch Fyne, a narrow and comparatively deep fjord, barred off by two shoals which cross it from shore to shore, but continuous so far as its surface is concerned. The Arran Basin also communicates eastward with a long stretch of comparatively deep water, which I term the Dunoon Basin. This is joined from the east by the shallow estuary of the Clyde; and to the north a series of fjords, Loch Strivan, the Holy Loch, Loch Goil, Loch Long, and the Gareloch, branch into the mountainous region toward the direction of Loch Fyne. Each of these natural divisions has a character in some respects peculiar to itself, but for general purposes it is sufficient to consider one example of each of the chief types. Accordingly, we select the *Channel* outside the Clyde Sea Area, the *Arran Basin*, *Loch Goil*, and the *Gareloch* as examples.

Table I. contains the more important statistics regarding them.

TABLE I.—TYPICAL DIVISIONS OF THE CLYDE SEA AREA.

Name.	Length.	Area, sq. sea-miles.	Depth low water, fathoms.		Volume, cub. sea-miles.		Average salinity.	
			Average.	Max.	Low water.	Tidal Increment.	Total salt %.	% Sea water.
Arran Basin ...	50	531·00	34	107	18·037	0·690	3·360	96·0
Loch Goil	5	2·61	14	47	0·037	0·004	3·230	92·3
Gareloch	5	3·28	7½	24	0·024	0·005	3·136	89·6

The deep water of the Arran Basin is separated from the deep water of the Irish Channel by the mass of the Great Plateau. The Dunoon Basin is similarly though less completely barred off from the Arran Basin; Loch Goil is much more effectually barred off from the Dunoon Basin, the bar at its mouth rising to within 8 fathoms of the surface, while the deepest water inside is 47 fathoms. Thus each of these divisions is more restricted as regards communication with the open sea than the one before, and each is in a similar ratio more exposed to the influence of the surrounding land. In the case of the Gareloch opening off the shallow estuary, and consequently filled with water of much less salinity than the other divisions, the isolation from marine influence comes to a maximum.

The usual rise of water-level from low tide to high tide is about 1½ fathom, and the tidal current rarely exceeds about 2 miles per hour, except in the Channel off the Mull of Cantyre, and at the narrow and shallow entrances to the lochs, where the stream at flood and ebb is sometimes as rapid as 6 or 7 miles per hour. The hour of high water is practically the same for the whole Area.

The observations on which this paper is founded were carried out for the Scottish Marine Station by Dr. John Murray, of the *Challenger* Expedition, and the author on the steam-yacht *Medusa*, which is specially equipped for such work, between 1886 and 1889. They included observations of temperature at all depths, and of density at surface, bottom, and occasionally at intermediate positions repeated at intervals of a month or longer at 70 stations distributed over the Area.

The first and second portions of the complete discussion of the work, entitled "Physical Geography" and "Salinity and Chemical Composition of the Water," were published in the *Transactions* of the Royal Society of Edinburgh, vol. xxxvi. Part III. No. 23, 1891; and the third and much larger part, dealing with

"Temperature," is published in vol. xxxvii. of the same publication. This paper deals only with the general conclusions of the temperature discussions.

The climate of the Clyde Sea Area is mild and equable The average annual temperature of the air is 47·3° Fahr., the extreme mean monthly temperatures being 39·4° for December and January, and 57·8° for July and August, a range of 18·4°. The years under observation were on the whole slightly colder than the average. The prevailing wind is south-westerly, although the direction is much altered by the configuration of the land, having a tendency to blow along the fjords, either up or down. Rainfall is heavy; in the landward portion amongst the rugged hills of the Highlands and over the narrow lochs the annual precipitation averages 56 inches, while over the lower land and wider water-surfaces of the seaward portion it averages 43 inches. The rainiest months are also the coldest, January and December, the average for each of which is 6 inches; while the driest month is May, with an average precipitation of only 2·5 inches. During the years under consideration the rainfall was nearly 10 inches per annum less than its average value. The density of the water varied with the rainfall, and the average value of the salinity in percentage of total salts to the mass of the water for the three representative divisions is given in Table I. There is also added the proportion of pure sea-water present on the average in each division, taking as "pure sea-water" that containing 3·5 per cent. of salts.

The temperature *régime* of the Channel must be considered in relation to that of the Clyde Sea Area, for it supplies the water which enters the system at every flood tide. The thermal peculiarity of the channel is that at any given time the temperature from surface to bottom is practically the same, a condition which I call *homothermic*. Since heating or cooling by radiation tends to produce a stratification of still water according to temperature, or a *heterothermic* condition, in which the surface water most readily responds to seasonal changes, it follows that where homothermic conditions prevail in summer and winter alike, the result must be brought about by continuous mixture of the water in a vertical sense. This is produced in the Channel by the strong tidal currents and the extremely irregular character of the bottom, which causes the deeper water to rise and mix thoroughly with the upper layers. As the season advanced, from the annual minimums of sea-temperature in March the whole depth of water in the Channel heated up steadily and uniformly, the deepest layers growing warm as rapidly as the surface, and after the maximum in September, the temperature fell simultaneously through the whole depth of the water, the temperature curves in all cases being straight lines.

The Arran Basin communicates with the Channel by slices of water carried to and fro by the tides across the Great Plateau. At the time of minimum temperature the water is homothermic, and has practically the same temperature as that in the Channel; but it heats up most rapidly on the surface and more slowly at great depths. The lower layers change their temperature homothermically, but as the rate of heating increases with the advance of summer, the depth of homothermic water diminishes, until at the maximum it usually disappears, and there is a fall of temperature from surface to bottom. During cooling the water changes its temperature with almost equal rapidity at all depths, and at the bottom the period of cooling from the maximum to the minimum is only one-third as long as the period of heating from the minimum to the maximum. This greater rapidity of cooling is due to the establishment of downward convection as soon as the chilling of the upper layers equalizes the density *in situ* of the surface water and that of the slightly more saline water below.

During cooling the surface remains colder than the deeper layers, but the range of temperature between surface and bottom is always much smaller during cooling than during heating.

Loch Goil, much more isolated than the Arran Basin from oceanic influence, shows all the characteristics which distinguish the Arran Basin from the Channel, but in an exaggerated degree. At the annual minimum in early spring the mass of water is homothermic, and practically at the same temperature as in all other parts of the Area, but the surface alone heats up rapidly as the season advances. The mass of water below the level of the bar heats very slowly, and only to a slight extent. It was evident that heat from the surface-layers was transmitted downwards mainly by the slow process of conduction, the maximum temperature at the bottom being reached in early spring, nearly six months after the date of the surface maximum, and only a month or two before the minimum temperature reasserted itself from top to bottom. The vertical distribution of temperature is thus subject to remarkable changes. The curve of the minimum is homothermic as elsewhere, the curve of heating shows a great range of temperature, and when cooling sets in its upper part is reversed in direction.

The cold of winter may have reduced the upper layers of water to 34° or less, while the heat of the previous summer is still being conducted downwards, and the water remains warmest in the centre and colder both above and below.

The Gareloch, although of nearly the same superficial area as Loch Goil, is only half as deep, and shows very clearly the effect of its land surroundings in the rapid heating and cooling of its water. The curves representing the vertical distribution of temperature are of four types corresponding to the seasons. The typical conditions at both minimum and maximum are homothermic; during heating the surface water is much hotter than that beneath, and while cooling is in progress the surface is correspondingly colder. The maximum temperature of the water was higher, the minimum lower, and the rate of gain and loss of heat more rapid than in any of the other divisions of the Clyde Sea Area. It was found that the seasonal march of temperature-change was very irregular, each of the three years during which observations were fairly complete showing very conspicuous irregularities. These were largely due to the action of wind in producing vertical circulation in the deep basins. Thus when a strong wind had been blowing up one of the lochs in summer, from the mouth towards the head, a great accumulation of the warm fresh water skimmed from the surface accumulated at the head of the loch, while upwelling of the deeper and colder water occurred near the mouth. Similarly, if a strong wind had been blowing down the loch, from the head toward the mouth, the warm and fresh water was found extending to a considerable depth near the mouth, while at the head the intensely salt and cool water from below was welling up on the surface. This circulation sometimes appeared to extend through the whole depth of a basin, but more frequently it was confined to the upper layers, and its nature, as indicated by the direction of the isotherms drawn on an exaggerated profile of the loch-basin, was curiously complicated.

The general seasonal changes of temperature are given in Table II., which is deduced from curves which were drawn in such a way as to eliminate local disturbances as far as possible. This table applies to 1887, a typical year with a summer somewhat hotter and drier than the average. The temperature of the air is an average for that over the whole Clyde Sea Area, the local readings being somewhat various. The temperature of the upper 5 fathoms shows a fairly close agreement in all parts, the Gareloch and Loch Goil being almost identical, and the yearly mean for the whole being practically the same. It is interesting to observe that the annual mean temperature of the upper 5 fathoms of water is 1·8° higher than the annual mean temperature of the air at the surface, and that thus the water on the whole exercises not only a moderating, but an elevating influence on air-temperature. The mean temperature of the surface is greatest for the open sea and

least for the narrow land-locked lochs; indeed, it was a fact constantly observed that the water was warmed from the ocean inwards.

TABLE II.—MONTHLY MEAN TEMPERATURE FOR 1887, OF AIR AND WATER IN THE CLYDE SEA AREA.

Division.	Jan.	Feb.	Mar.	Apl.	May.	Jun.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Year.
AIR (MEAN)	39·1	40·6	39·4	43·0	49·9	58·6	59·8	57·2	52·6	45·4	41·3	37·6	47·0
WATER, SURFACE LAYER OF 5 FMS.—													
Channel	47·2	44·6	44·1	44·8	46·0	48 4	51 6	55·3	55·9	54·0	51·4	48·2	49·3
Arran Basin	44·2	42·9	42·9	45·2	48·0	51·8	54·4	55·2	55·2	53·8	50·8	47·0	49·3
Loch Goil	43·6	42·1	42·7	45·1	48·1	51·0	55·0	57·5	55·6	51 8	48·2	46·3	48·9
Gareloch	42·8	44·3	42·4	44·2	47·3	52 0	56·8	58·0	55·6	51·5	47·2	44·8	48·7
WHOLE MASS OF WATER—													
Channel	47·2	44·6	44·1	44·8	46·0	48·4	51·6	55·3	55·9	54·0	51·4	48·2	49 3
Arran Basin	44·5	43·7	43·5	44·4	46·2	48·4	50·2	52·0	52·1	50·4	48·5	46·3	47·5
Loch Goil	46·0	44·8	43·9	44·2	45·2	47·3	50·0	52·7	52·8	51·1	49·4	47·9	47·9
Gareloch	43·2	42·6	42·8	44·1	46·8	51·2	56 0	58·0	56·0	51·2	47·4	45·5	48·7

Table III. shows that the air was warmer than the surface layer of water for a shorter time over the Channel and in the Gareloch than over the deep lochs or basins, while the annual maximum of surface-temperature was retarded 42 days in the shallow Gareloch, 47 days in the more oceanic divisions, and 54 days in Loch Goil, after the date of air maximum. The curves of annual variations of air and water temperature showed that the retardation of phase in the curve of water-temperature was determined by the fact that the descending curve of air-temperature always cut the curve of water-temperature at its maximum. Thus when the water heated rapidly owing to a hot summer, its maximum occurred shortly after that of the air, because a short time of cooling brought the air down to the temperature of the water, and stopped further heating. On the contrary, when the water heated up slowly to a low maximum, there was a much longer retardation on account of the time which the air required to cool down to the temperature of the slowly warming water.

TABLE III.—RELATION OF AIR AND WATER TEMPERATURE IN THE CLYDE SEA AREA (MEAN OF 1886 AND 1887).

	Air.	Channel.	Arran Basin.	Loch Goil.	Gareloch.
Excess of surface water over local air-temperature (mean annual)	—	1·7°	1·7°	1·8°	1·9°
Days air warmer than surface	—	134	136	138	124
„ cooler „ „	—	237	228	236	248
Retardation of surface maximum after air maximum, days	—	47	47	54	42
Retardation of 35 fathom maximum after air maximum, days	—	47	51	165	—
Days of mass-cooling per 100 of heating ...	125	115	100	99	130

The lower part of Table II. gives the mean monthly temperature of the whole mass of water in each division, and shows how the annual range and the date of maximum and minimum are altered by depth and isolation. The mass of water in all the divisions except the Channel is colder than the surface layer during the period of heating, and warmer than it during cooling. The retardation of the maximum at a depth of 40 fathoms is shown to be the same as that for the surface in the Channel, 4 days later for the Arran Basin, and no less than 111 days later

for the restricted Loch Goil. The contrast of the temperatures at great depths is also well brought out in Table IV.

TABLE IV.—COMPARISON OF TEMPERATURE AT 40 FATHOMS.

	Channel.	Arran Basin.	Loch Goil.	Loch Fyne.
Minimum, April, 1886	42·0	41·2	41·5	42·0
Heating, June, 1886	47·0	44·0	42·0	44·0
Maximum, September, 1886	54·5	47·4	44·2	45·0
Cooling, December, 1886	48 6	47·6	47·6	45·0

The general result of the investigation is that in such a system of tidal waters as the Clyde Sea Area the natural divisions, when classified according to the order of restricted range and retarded phase of seasonal temperature and of lowered mean temperature, are found in the order of their accessibility to tidal water, this accessibility being conditioned both by depth and configuration, as well as by actual proximity to the sea. This demonstrates the supreme importance of configuration in dominating the seasonal changes of water-temperature.

I have only here attempted to summarize the main results of the investigation, and must refer to the original memoir for all particulars as to methods and details.

The observations allowed the following, amongst other conditions, to be established:—

1. The upper 5 fathoms of water over the whole Area had, on the average of a year, a temperature 1·8° higher than that of the air.

2. The curves of seasonal variation of temperature in water at different depths were retarded in phase and restricted in range as the depth of the water was greater, and as its degree of isolation from oceanic influence was more complete.

3. The descending seasonal curve of air-temperature always cuts the seasonal curves of water-temperature, both for the superficial 5 fathoms and for the whole mass, at their maximum.

4. The influence of wind in causing the accumulation of surface water on one shore or at one end of a fjord, and the welling up of deep water at the other, frequently produces profound redistributions of temperature in the water in a very short time.

5. When water is agitated throughout its whole mass by tidal or wind action, the seasonal changes of temperature take place simultaneously from surface to bottom throughout the whole depth.

MR. SCOTT ELLIOT'S EXPEDITION TO MOUNT RUWENZORI.

THE following communication, dated "Duwona, Toru, April 15, 1894," has been received from Mr. G. F. Scott Elliot, who left England last year to explore the Ruwenzori region.

I arrived at the foot of Ruwenzori on April 1, having left Kampala on February 20. My route has been a very roundabout one, through Budda, part of Karagwe and Ankole, and I have not travelled very hard. The time spent on the ordinary management of my caravan has been also very great, and left me very little for scientific work, and all that I

can say of the country is of rather a slight and superficial nature. I hope to bring back a rough map of the entire route, which, roughly speaking, borders the Victoria Nyanza as far as Kitangule, from which place I followed the Kagera to very near the point crossed by Stanley; from this spot (Kitaboka) I went almost in a straight line across Ankole (touching Stanley's route in two or three places) to Kiarutanga (see Lugard's map), thence to a ferry (Chanungera to Kuliafiri's), which lies a little south of Bukarungu, and so got to the foot of Ruwenzori. The only unknown parts of this route, so far as I know, are the course of the Kagera and some portions of Ankole. The former river is a deep, rapid current full of hippopotami, and varying from 80 to 130 yards in width. The current is at Kitangule some 2½ miles per hour, but higher up at Kitoboko it is much more rapid, probably 4 miles per hour. It has a very winding course as far as Butunguru, but after this point becomes much more direct. This point (Butunguru) marks the termination of an enormous alluvial plain, which is obviously the ancient level of the Victoria Nyanza, and after it one enters the mountains of Karagwe, which are continuous with the Ruampala range, and with one break extend almost to the shores of the Albert Edward. The plain above alluded to consists at Kitangule of some 30 to 35 feet of apparently very rich alluvial soil; it appears to slope gradually to the Victoria, and ends in a succession of heavy forests or swamps which are under water in the wet season, until finally the open water is reached. I think with irrigation this part of Buddu and Karagwe should be of inestimable value, but at present cultivation is almost confined to the various hills that rise out of it.

In Ankole the most interesting feature I found was a series of large lakes (Mbiro Nyanza), five in number, on or very near the course of the Ruizi; this river is quite different in character to the Kagera, and more like the river marshes of Buddu and Uganda. It rises amongst the hills at Katara (see Stanley's map), forms the Wamaganga swamp mentioned by Stanley, and then passes through a plain some 8 to 15 miles broad (the break alluded to above), flows close to the lakes Mbiro Nyanza, and, after passing through Kaki, enters the Victoria Nyanza between the Narudugavu and the Kagera. It does not join the Kagera, as shown on most maps. These details are, however, scarcely intelligible or interesting without a map, which I hope to produce in time.

As far as I can understand the geology of the country, both Uganda Buddu and a large part of Toru have been originally a granite plateau some 4300 feet high. This plateau even forms a border 8 to 10 miles wide round the Albert Edward Nyanza, which I passed after leaving the Ankole hills. The most curious feature it presents is the manner in which it is cut up by swamp rivers into an interminable series of hills, which render travelling almost intolerable. On this granite is a series of schists folded over and over and changing in character, which

extend with interruptions to the base of Ruwenzori. These schists begin at Butunguru, and I have traced the same rocks right across Ankole to Burimba, where one descends to the granite. I have never found them at a dip of less then 80°, and their strike is some 20° to 30° east of north. They probably contain valuable minerals, but I do not care to risk an opinion on them now. It is extremely difficult to get good specimens, and one can only carry a few in this country, but the few I have should, I think, show their character.

The numerous valleys in these Ankole and Karagwe mountains are of a most curious character. They are deep, well-like trenches (perhaps 1500 feet deep on an average), and form a most intricate meshwork. A large number of villages are scattered on the hillsides, but more often at the bottom of these valleys; but the country as a whole suffers from the lack of water. The hills are covered with short grass, and should, I think, prove good grazing-ground for sheep and cattle.

Even constant travelling has not affected the health of the sheep and the unfortunate cow which have come with me, and this is a fair test of the pasture. There has been, however, such constant raiding that the country is almost destitute of cattle. The degrees of ferocity in the peoples are very curious. The Waganda come first, and have stolen from Unyoro, Koki, and Ankole. Ankole has stolen and is stealing from Mpororo, and is stronger than the unfortunate Koki, and so on. As to the people themselves, I found the Wa-Karagwe very friendly, but extremely poor, and in great awe of Europeans. I could distinguish no marked difference between them and the Wa-Ankole, except in character. The latter, though I travelled under the protection of their king Antari, killed one of my men, and it was easy to see that without protection I should have had to fight almost daily. This unfortunate man exemplifies one of the exasperating features of the Swahili porter. He had one hand, and wandered out by himself to find pembe to drink without gun or spear, and never returned; it was a country he knew to be unsafe, and where no one has anything but a goatskin hung on the shoulder, so that his clothes were of great value. It is almost impossible to make the Swahili, though he is anything but brave, understand ordinary prudence, and they will not obey one's orders on their own behalf.

The greatest want of all these countries is a ready and cheap means of communication with the coast. My reason for the roundabout route followed was to see whether the Kagera was a navigable river, but so far as I can see it is not of great promise in this respect. As far as Butunguru, it is a deep, broad stream, without rocks or rapids, and lighters could be brought to this point by steamer easily enough, the only difficulty being the rapidity of the current, numerous bends, and the extraordinary number of hippopotami. Of these latter I have seen eight or ten together frequently, and one finds them every mile or so

along its course. Above this point there are rocks and a current so strong as to make navigation very difficult. The valley of the Kagera, however, would make an almost perfect railway track, so far as I have seen, and along the Mavona valley, which joins it, a track could probably be made with great ease into the heart of Ankole, and probably up to the Ruizi valley or plain. Ox-waggons seem to be the only substitute for a railway line, for which no revenue could be had in Ankole for many years. On the other hand, from the Albert Edward a railway line or even a cart track into Ankole could not be made from the north end of the Albert Edward without ruinous expense, and I fail to see how either could be made to Uganda, on account of the large number of tributaries both of the Mpango river and the Katonga.

As far as the plants are concerned, I find the same species of a very weedy character extending from Kavirondo to at least 5000 feet on Ruwenzori, and the majority extend from the coast. This does not apply, however, to the forests (of which I found none in Karagwe or Ankole) or the hills above 5000 feet. Since arriving here I have had constant attacks of fever, and been able to do nothing; but in a very short time I hope to get a camp established at a good height. Unfortunately, there is no European official here, and political affairs are not as they should be; Kabbarega's army also passed over this side of Ruwenzori and devoured most of the food; locusts have eaten a large portion of the remainder; lions and leopards have taken to eating men in the absence of sheep, and have already severely wounded two of my men, and things generally are anything but satisfactory. There is a good deal of game on the side of Ruwenzori about Fort Edward. On one day I saw nine elephants, and two days afterwards twenty-five! None took the least notice of the caravan, though we passed within 500 yards of some of them.

THE SUGAR-LOAF MOUNTAIN, MOZAMBIQUE.

By WILLIAM A. CHURCHILL, H.B.M. Consul at Mozambique.

The following account of a visit to the Sugar-Loaf Mountain, Mozambique, by Mr. William Churchill, H.B.M. Consul at Mozambique, has been forwarded to the Society by the Right Hon. the Earl of Kimberley:—

I have the honour to write to your lordship an account of a walk I took in the Makua country as far as Sugar-Loaf Mountain, which is within my district and in the vicinity of Mozambique. My reason for reporting on such a trivial matter is because for some years past no resident of Mozambique has visited Sugar-Loaf Mountain, although it is visible from Mozambique in clear weather; indeed, it forms a conspicuous landmark, which is of use to vessels navigating near this coast. The principal objection found by explorers is the existence of hostile

natives, called Namaralo, who have gained the reputation of being brave robbers. This tribe has given the Portuguese no end of trouble. They periodically raid and loot such places as Mpapa and Msiriri (Portuguese, Mosuril), the chief market gardens that supply Mozambique with fresh provisions. The sufferers of these robberies are generally Indian traders. These robbers have never been punished by the Portuguese. They have made several attempts to do so, but have always failed. Not only do the Portuguese appear to be convinced of the hostility of these natives, but the natives of Mozambique are afraid of them, and report that they are slave-raiders and traders.

Mr. Hollis, United States Consul at Mozambique, came with me on this walk. Our caravan consisted of fifteen men. Those who could shoot straight were armed, and we carried provisions to last five days. We tried the experiment of employing donkeys to carry loads, but it was unsuccessful, because we had no pack-saddles; the loads were continually falling down, and the natives were unable to secure them.

On a previous occasion a guide had taken me in a devious direction, and after nine hours' walking I found that I was not halfway to the mountain. He was afraid to tell me that he thought my equipment was insufficient to enable me to penetrate into the Namaralo country. On this occasion I took no other guide than the compass, and, crossing the Msiriri creek, followed the Portuguese road to Natuli, 5½ miles from Msiriri, where there is a Portuguese mud fort. From here we struck north-west and went through a dense forest. We stopped in the Namaralo country at four o'clock in the afternoon, after having walked since six o'clock in the morning. The natives came to our encampment immediately, and sold us provisions, and fetched water for our men. They appeared as good-natured and friendly as the natives of Mozambique. Many of the youths were armed with trade guns, while others were employed in cultivating small clearings in the forest. We observed mango and cashew trees near the villages; and plantations of manioc, millet, maize, beans, ground-nuts, and tobacco. The huts were all circular-shaped.

On the next morning at six o'clock we continued our walk, crossed the dry bed of the Muhekati stream, and arrived at the mountain at midday. The forest was so dense that we did not see the mountain from the time of our starting until we arrived at its base. The Muhekati is a stream only in the rainy season, when it empties its waters into the Msiriri creek. At present water is found in the sandy bed by digging for it.

Sugar-Loaf Mountain (Makua-Mtipa; Portuguese, Monte Pão) is distant from Mozambique 26 miles as the crow flies, but I should think that the distance travelled by us was 7 miles by sea and about 30 by land. On the following morning we explored the mountain, and found it to be composed of coarse granite in which much mica was visible. According to the aneroid, it is 1050 feet above the level of the sea. From the top of the mountain we could see Mozambique, Table Mountain

(Mesa), and a range of mountains about 40 or 50 miles away. With the exception of a few isolated hills here and there, the neighbouring land was observed to be extremely flat and covered with forest.

There were swamps at the foot of all the hills passed by us, with clumps of bamboo growing near them. The forest trees are tall and handsome, and the wood is generally hard. Some of the trunks are quite straight. The Mtili variety looks very much like the trees in the Boulevards at Paris.

We were told that big game existed, but we neither saw nor heard any; nor did we see traces of them, although we spent three nights in the forest. We saw guinea-fowl, hawks, and a variety of crow differing from that of the east coast. The mountain crow is larger than those of the coast, has a larger bill tipped with white, and, instead of having white feathers all round the neck as in the coast kind, it has them only on the back of the neck. A specimen was shot, and its skin preserved. The guinea-fowls were of the blue crested variety, and were difficult to shoot on account of the thick, long grass in which they were hidden.

The first orchid I have seen here was found on a tree at a height of about thirty feet from the foot of the tree. We saw plenty of orchella weed on the mountain, as well as two varieties of plants seen in no other part of this country. Specimens were secured and taken to Mozambique.

We returned at half-past seven on the morning of the fourth day, and arrived at our starting-point at Msiriri at five o'clock in the afternoon of the same day. Our fresh-water supply having given out, we found it necessary to accelerate our pace.

Near Sugar-loaf Mountain we passed by a village and saw a Portuguese flag flying over the principal house. The flag had been given to the natives at the end of June last, on the occasion of the signing of a treaty of friendship between the Portuguese and one of the chiefs of the Namaralo tribe, who only recently looted the trading village of Mpapa.

The Namaralo are divided into two parts. Those under the old chief Mkuto-mno, or, as the Portuguese call him, Matula-muno; and those under the young chief Mkubwe-mno. The old man is inclined for peace, and is the one who has made a treaty with the Portuguese. The other evidently wishes to take his fling first. We passed through the country of both chiefs without the slightest opposition or difficulty, nor were presents demanded or given for our right of way. So there appears nothing terrible about a journey through the country of this tribe.

We frequently met small gangs of armed men carrying ground-nuts and other produce to the coast for barter. Ground-nuts are the principal articles of export. The district of Mozambique comprised between those of Cabo Delgado and Angoche produces about three thousand tons of ground-nuts for export annually, and I believe the share of the Namaralo tribe is about two hundred and fifty tons. I do not think it can be more, as the population cannot be large. While on the top of Sugar-Loaf

Mountain we noticed very little smoke which would indicate the villages, and we only saw four villages on our way. We were told that the fighting men numbered three hundred thousand, but I do not believe the whole population can exceed two or three thousand, and the armed men four or five hundred.

I believe that accounts about the Namaralo are much exaggerated. They certainly live by robbery as well as industry, as many less barbarous people continue to do. I also believe that trading centres can without much difficulty be protected from them. At present the principal trading centres are unprotected, and the forts protect no traders.

GEOGRAPHY AT THE BRITISH ASSOCIATION, OXFORD, 1894.

THE British Association met at Oxford from August 8 to 15. The following were the office-bearers of Section E (Geography):—

President.—Captain W. J. L. Wharton, R.N., F.R.S. *Vice-Presidents.*—Prof. Guido Cora; J. Scott Keltie; H. J. Mackinder, M.A.; the Hon. George Brodrick, Warden of Merton College; Admiral Sir Erasmus Ommanney, C.B., F.R.S.; E. G. Ravenstein; Henry Seebohm, F.L.S., F.Z.S; Lieut.-General R. Strachey, R.E., C.S.I., F.R.S. *Secretaries.*—J. Coles, F.R.A.S.; W. Scott Dalgleish, LL.D.; H. N. Dickson, F.R.S.E.; Hugh Robert Mill, D.SC., F.R.S.E. (*Recorder*). *Committee.*—Col. Godwin-Austen, F.R.S.; J. Theodore Bent; W. T. Blanford, LL.D., F.R.S.; John Bolton; G. G. Chisholm; A. W. Clayden, M.A.; H. T. Crook; B. V. Darbishire, M.A.; Major Leonard Darwin, M.P.; H. O. Forbes, LL.D.; Rev. H. B. George; J. W. Gregory, D.SC.; Professor A. C. Haddon; Rev. J. F. Heyes; H. G. Hogarth, M.A.; Sir H. Howorth, M.P., F.R.S.; John Murray, LL.D.; H. Yule Oldham, M.A.; Commander Dubois Phillips, R.N.; Sir Lambert Playfair, K.C.M.G.; Sir Rawson W. Rawson, K.C.M.G., C.B.; Howard Saunders, F.Z.S.; Trelawney Saunders; Professor H. G. Seeley, F.R.S.; G. E. T. Smithson; Eli Sowerbutts; Canon H. B. Tristram, F.R.S.; Professor Arminius Vambéry.

At a meeting where nearly every Section had matters of special interest brought before it, Section E was well to the front, and the interest and popularity of the proceedings were sustained throughout. The meetings were held in the large North Writing School of the new examination buildings, which was almost always well filled by an audience above the average of former years. It is somewhat difficult to select any special features of the proceedings for notice, the record being chiefly one of solid hard work in many departments of geography; but a gratifying recognition of the immense range of geographical work was afforded by Dr. John Murray's paper on the "Geographical and Bathymetrical Distribution of Marine Organisms," which was listened to by a strong contingent of zoologists, who joined in the subsequent discussion. We may again remark on a great increase in the number of

lantern slides exhibited, as showing the almost unlimited applications of photography to the purposes of geographical research. Several papers were by this means made intelligible to a large audience, which without their aid would have appealed only to a few specialists.

Captain Wharton's presidential address on Thursday has already been published in the *Journal*, and as most of the papers will appear either in full or in abstract, the present article will be restricted mainly to a general review of the proceedings. After a cordial vote of thanks had been accorded to Captain Wharton, Colonel H. W. Feilden read a paper on "Current Polar Exploration." Mr. D. G. Hogarth then gave an account of his researches in Asia Minor, and was followed by Dr. A. Markoff on Russian Armenia. The work of the day concluded with Mr. Cozens-Hardy's paper, "Montenegro and Albania."

Friday forenoon was chiefly occupied with papers on physical geography. Dr. H. R. Mill summarized the results of his survey of the English lakes, and, on behalf of M. A. Delebecque, described the similar work of that investigator on the lakes of France. Mr. H. N. Dickson followed with a paper on the "Seasonal Movements of the Water in the North Sea and North Atlantic." Mr. John Thomson then submitted a paper on Geographical Photography, in which he dealt with the difficulties experienced by travellers, especially in tropical countries, in the use of photography as an aid to exploration. Practical hints were given for preserving plates and negatives, and for correcting errors in exposure and development, good and bad examples being exhibited in the lantern.

In the afternoon, Mr. H. Yule Oldham read an extremely suggestive paper on "A New Light on the Discovery of America." Mr. Yule Oldham's conclusion that there is satisfactory evidence of South America having been discovered in the year of the birth of Columbus, was somewhat severely criticized in the discussion which followed; but it was agreed that his methods were worthy of extended application. Mr. O. H. Howarth read a paper on "Explorations in the Sierra Madre of Mexico," in which he discussed the physical features common to the whole western range of North America, from Oregon to Guatemala, and compared them with those of the Atlas and Caucasus ranges. The variations of climate in the Sierra Madre, and their effect upon mountain-dwellers, including certain of the isolated Indian tribes and the cave-dwellers of Sonora and Chihuahua, were described and illustrated; and much new light was thrown on the physical geography, geology, and ethnology of these little-known regions.

On Monday morning the meeting opened with a paper by Miss Frances Baildon, describing a visit to British New Guinea. The author and her brother visited Port Moresby in August 1891, and, after a short stay, proceeded westward along the coast for 150 miles to Motumotu, whence a canoe-voyage was undertaken to the inland village of Moviavi. Mr. E. G. Ravenstein read a very important paper on the "Climatology

of Tropical Africa," forming the report of the Committee on that subject. Mr. H. Weld Blundell described a visit to Siwa and other places in the Libyan desert; and Colonel Godwin-Austen gave some hitherto unpublished material collected during the journey of the last mission to the court of the Dhurm and Del Raja, under the late Sir Ashley Eden, in 1864, concerning Bhutan and the Eastern Himalaya. A paper by Mr. G. G. Chisholm, on the "Orthography of Geographical Names," was followed by a discussion which occupied the remainder of the afternoon.

On Tuesday morning a paper by Mr. J. Y. Buchanan, on "Researches by the Prince of Monaco in the North Atlantic and in the Mediterranean during the Summer of 1894," was read by Dr. Mill. The recent work of the yacht *Princess Alice* shows that, for a considerable distance to the east of Gibraltar and Ceuta, the surface-water is mainly derived from the Atlantic. The normal temperatures observed varied from 15° C. to 17·4° C., but under the influence of hot winds readings as high as 29° C. were obtained. An improved form of dredge, devised by the Prince of Monaco for use in deep water, has afforded some new information with regard to the fauna of a very striking character. Dr. Mill next read the report of the Committee on Antarctic Exploration, which has had few opportunities of work during the past year, owing to the small development of fishing enterprise in those regions. It was agreed to bring the claims of Antarctic research prominently before the Council of the Association, with the view of urging that a memorial be presented to Government, representing the great scientific results to be expected from a properly equipped Antarctic expedition. Mr. Keltie communicated a paper by Mr. A. Montefiore, on the outfit and equipment of the Jackson-Harmsworth expedition. Dr. Murray discoursed on the distribution of marine organisms, first giving a luminous exposition of our present knowledge of the facts, and then attempting to account for the separate polar belts of identical fauna in the northern and southern hemispheres by the supposition that at one time the entire globe enjoyed a uniform climate, the sun being then possibly as large as the orbit of Venus. The distribution of animal life would under such circumstances also be uniform, and inequalities would arise with inequalities of climate due to the shrinkage of the sun, and consequent curtailment of the area exposed to its vertical rays. After the discussion on Dr. Murray's paper the Section adjourned, and in the afternoon Mr. Bent gave an account of his journeys in the Hadramut, his paper constituting the report of the Committee on the exploration of that district. Mr. Somers Clarke presented a paper on the geography of Lower Nubia, which dealt chiefly with the country which would be flooded by the proposed Nile reservoir. He pointed out that the projected reservoir nearly coincides with the Wadi Kenus, the abode of the Beni Kensi tribe, and that if the scheme is carried out in its present

form, 10,000 acres of cultivable land will be submerged. In view of the contemplated destruction of many unique antiquities, as well as of the home of an extremely interesting people, Mr. Clarke urged the need of an exhaustive scientific survey of the district. Professor Norman Lockyer and Mr. F. C. Penrose, who took part in the discussion which followed, supported Mr. Clarke's proposal.

The work of the section concluded with some illustrations by Mr. B. V. Darbishire, of a new method of representing the vertical relief of the British Isles. The usual votes of thanks were then awarded to the Local Committee, and to the President, Vice-Presidents, and Secretaries of the Section.

Mr. W. H. White was unable to deliver his lecture on Friday evening, and his place was taken by Dr. J. W. Gregory, who discoursed to a large audience in the Sheldonian Theatre on "Experiences and Prospects of African Exploration." It is seldom that a geographer is selected to deliver one of the evening lectures, and the success achieved by Dr. Gregory is therefore all the more gratifying.

THE MONTHLY RECORD.

EUROPE.

Population at Different Elevations.—The distribution of population in regions having different elevations continues to receive increased attention amongst continental geographers. Signor Marinelli Olinto contributes to the *Rivista, Geografica Italiana* an interesting discussion of the population statistics of Sicily. The data are obtained from the *Annuario statistico italiano* for 1889–90, in which the results of the census of 1881 are arranged according to zones of elevation above sea-level. Dividing the island into three slopes, the Mediterranean, the Tyrrhenian, and the Ionian, the author made careful planimetric measurements of the contour lines from Fritzsche's recent map, and from the areas obtained computed the mean density of population. The results are as follows:—

Height (metres).	Inhabitants per square kilometre.			
	Mediterranean.	Ionian.	Tyrrhenian.	Sicily.
0–50	74·3	340·5	1003·0	353·2
50–100	51·3	99·0	160·6	93·4
100–200	72·9	130·8	97·9	92·3
200–300	38·4	64·1	78·6	55·1
300–400	69·5	53·5	112·8	74·5
400–500	137·4	41·0	114·2	108·5
500–600	159·8	150·7	120·8	146·5
600–700	202·8	146·0	76·4	147·6
700–800	90·2	137·1	94·0	106·2
800–900	32·6	83·6	29·6	46·1
900–1000	156·1	12·0	96·4	74·9
Above 1000	122·8	34·5	32·6	43·7
Total ...	92·2	112·6	148·7	113·4

Further, the following table is obtained by graphic methods:—

Slopes.	Average height at which the population is found.	Mean height of the land.	Ratio.
	Metres.	Metres.	
Mediterranean	439	372	1·18
Ionian	283	522	0·54
Tyrrhenian	250	473	0·54
Sicily	339	441	0·77

The numbers are certainly extremely irregular, but, assuming that on the whole the density of population is normally greatest near sea-level, they confirm the view, expressed by Réclus and others, that a liability to invasion tends to drive the centres of population towards more elevated regions away from the coast. The peculiarity, so strongly marked on the Mediterranean slope, will probably disappear in more peaceful times and under more settled government. Dr. Karl Grissinger contributes to the *Mitteilungen der k. k. Geographischen Gesellschaft* an elaborate statistical paper on the distribution of centres of population in Austria-Hungary. Centres of more than 2000 inhabitants are discussed in detail, and subsidiary tables are given relating to centres exceeding 5000, 10,000, 20,000, 50,000, and 100,000. The area is divided into five approximately equal districts, each of which is treated separately, and in individual cases the results are of undoubted interest. While the number of centres of population occurring within a certain area seems to follow the density of population pretty closely, it does not appear that arrangement according to elevation affords much help in discussing the complex causes which determine their distribution.

The Bathymetrical Survey of the French Lakes.—We have received the 'Atlas des Lacs Français,' recently published by the Ministère des Travaux Publics, which contains ten plates of maps of the French lakes, with contour-lines at intervals of 5 or 10 metres, based on the elaborate soundings of M. A. Delebecque. M. Delebecque communicated a paper to Section E of the British Association, describing the methods he has employed, and a set of his maps was exhibited. In the earlier parts of the work the sounding-apparatus of the Swiss Bureau Topographique was used, but this was subsequently replaced by a Belloc machine, and ultimately by one of M. Delebecque's own invention. In every case the measurements depended on the number of revolutions made by a graduated drum, on which the steel sounding-wire was wound, and M. Delebecque's instrument had a great merit in respect that its total weight amounted to only 9 lbs. The position of each sounding was determined either from angular measurements of the graduated mast of the boat taken from the shore, or by sextant bearings taken from the boat. It would accordingly appear that the maps are founded on measurements of great accuracy. They include the following lakes: Lake of Geneva (the Swiss part sounded by M. Hörnlimann, of the Bureau Topographique Féderal), scale $\frac{1}{50000}$; Lake of Bourget, scale $\frac{1}{20000}$; Lake of Annecy, scale $\frac{1}{20000}$; Lake of Aiguebelette (Savoy), scale $\frac{1}{10000}$; Lake of Paladru (Isère), scale $\frac{1}{10000}$; Lakes of Brenets, St. Point, Romoray, and Malpas (Doubs), scale $\frac{1}{10000}$; Lakes of Nantua, Sylans, and Senin (Ain), scale $\frac{1}{10000}$; Lakes of Chalain, Dessus, Dessous, Marlay, La Motte, Grand Maclu, and Petit Maclu (Jura), scale $\frac{1}{10000}$; Lakes of Saffray and Petit Chat (Isère), La Girotte (Savoy), Issarlés (Ardèche), Bouchet (Haute Loire), Pavin, Chauvet, Godivelle, and Tazanet (Puy-de-Dôme), all scale $\frac{1}{10000}$. This long list represents only a part of M. Delebecque's

work, as a large number of other lakes have been roughly sounded, and many observations of temperature and chemical composition have been made. The atlas is to be completed by maps of several lakes in the Jura and in the Pyrenees, and will then only form part of a comprehensive memoir on the limnology of France.

ASIA.

Colonel Holdich on the Route of Alexander the Great.—Colonel Holdich's lecture at the United Service Institution at Simla on Alexander's retreat from India is an important contribution to an old subject, because of the author's personal acquaintance with the region under discussion, an advantage that many geographers have lacked. Potala, the point of departure, Colonel Holdich is inclined to place about 30 miles south-east of Hyderabad (General Cunningham's suggestion) and 60 miles east-north-east of Thata. Into Makran Alexander marched by the old mediæval route which connected it with Sind in the days of Arab ascendancy, a route that has been used as a highway into India for nearly eight centuries. After defeating the Oritæ near Luo Bela, Colonel Holdich considers that Alexander must have followed the valley of the Phur to the coast, and pushed on along the track of the modern telegraph line till he reached the neighbourhood of the Hingol river, where he made a considerable halt to collect food and supplies for his fleet. Here comes one of the more important of Colonel Holdich's identifications. Alexander's way to the west was then blocked by the Malan range, and there appears to be but one possible route that he could have selected. He must have ascended the Hingol till he could turn the Malan by the first available pass westward. Nothing has altered since his days, and the point where he left the Hingol seems to be fixed by the mention of the Parikanoi, which Colonel Holdich identifies with the bed of the stream called Parkan, skirting the north of the Taloi range, and leading westwards from the Hingol. The Sagittæ and Sacæ, two other peoples mentioned in history as tribes with whom he had to contend, seem to be found in the Sajidi, a tribe of Jalawan Brahins, of which the chief family is called Sakæ, and who occupy territory a little north of Parkan. At the time of the year that he was pushing his way along the Taloi hills, which rose 2000 feet above him on his left, there could not have been a drop of water to be had, and this fully accounts for the miseries that were crowded into this part of the march (about 200 miles) between Hingol and the coast. The point where the latter was struck was probably Pasni. Thence, as Arnan tells us, he marched for seven days along the coast till he reached the well-known highway to Carmania. Colonel Holdich points out that Arnan was probably right in declaring that it was Alexander's obstinate determination to do that which proved so fatal to Semiramis and Cyrus that led him to select the worst possible route through Makran, because the high-road was known even before his time. Some centuries later we find Makran "a country of great and flourishing cities, of high-roads connecting them with well-known and well-marked stages, armies passing and repassing, and a trade which represented to those that held it the dominant commercial power of the world. The history of Makran is the history of India from time immemorial. Not all the passes of all the frontiers of India put together have seen such traffic into the broad plains of Hindustan as for certainly three and possibly for eight centuries passed through the gateways of Makran. As one by one we can now lay our finger on the site of those historic cities, we can only be astonished that for four centuries more Makran has remained a blank on the map of the world."

The Ruins of Old Merv.—The ruins of the ancient towns of Merv have been carefully examined by Professor Skaukowskig, of St. Petersburg, from whose

description (in Russian) a short account has been given by L. Cohn in *Pet. Mitt.*, 1894, No. 3. They occur near the Bairam Ali station, on the Transcaspian railway, about 16½ miles from the present town of Merv, and represent three distinct former towns of different epochs, following in succession from north-east to south-west. Each was in the form of a fortress, surrounded by high walls, which are still to be distinguished. The oldest, "Gyaur-kala," was the Merv of the Sassanids and Arabs. In this, as in the other two, are the remains of a citadel. The only space within the walls is filled with mounds covered with broken tiles, the remains of former houses. The second fortress (Sultan-Kala) is that of the Persian Seljuks, whose capital it was. In the centre is the mausoleum of the most popular of these, Sultan Sandschara, showing traces of elegant architecture and rich ornamentation. Some of the fragments of tiles among the ruins have a blue glaze. A semicircular wall joins the northern and southern walls of Sultan-Kala, enclosing a space known as "Tskender-Kala." This is popularly attributed to Alexander the Great, but so far no proof exists that it has a different origin to Sultan Kala. The third fortress, "Bairam-ali-Khan-Kala," was destroyed little more than a hundred years ago by Murad-Bi of Bokhara, who removed many of the inhabitants by force. The walls and buildings, which include the palace, mosque, baths, an aqueduct, etc., are naturally in better preservation than in the older towns. Outside the walls for some miles there are ruins of houses built of clay or unburnt brick, mostly with courtyards surrounded by walls, traces of vineyards and mulberry groves still remaining in places. An attempt to learn more of the history of Merv from the descendants of its old inhabitants in Samarkand and Bokhara proved fruitless.

Samarkand.—The 'Almanack of the Samark and Province for the year 1894, published by the Statistical Committee, edited by M. Virsky' (Samarkand, 1894), contains, besides the usual lists of all functionaries, a valuable paper by the editor on the culture of the cotton-tree; an elaborate paper on the town of Samarkand and its district; and a variety of smaller papers on the trade of Bokhara, the changing value of its money, on the progress made in Samarkand during the last twenty-five years, and two medical papers, on the local medicine and witchcraft in use among the Sart women, and on the parasitical disease of the "rishta" (*Filaria medinensis*). No general census of the population has yet been made; it is simply calculated at so many persons in each *kibitka* of the nomads (five), and is estimated at 735,000 natives and 15,000 Russians. Of Russian settlers there are only five villages, all in the district of Khojent. The total crops in the province amounted to 8,640,000 quarters of cereals in 1892, as against 6,102,000 quarters in 1891. About 135 acres are under vineyards, and nearly 1,250,000 cwt. of grapes had been obtained, of which only one-tenth is used for wine. The culture of the cotton-tree makes rapid progress, the total crop of raw cotton being 516,800 cwt., of which 184,000 cwt., valued at 1,761,350 roubles (£176,135), of refined cotton were obtained for export to Russia. Mining has been on the decline. The petty trades of the population are valued at above 3,000,000 roubles. The province has 1932 Musulman schools, but only eleven Russian schools, or for Russians and natives; 18,670 boys and girls received education in these schools.

Changes at Aden.—In his paper on "Aden Harbour," published in the last volume of the 'Minutes of Proceedings of the Institution of Civil Engineers,' Mr. W. S. Child refers to certain changes in the topographical features of the district which, in his opinion, have taken place within historic time. The Wadi Alkabir, the only river flowing into the harbour, has from time to time changed its course, and formerly had, in all probability, two or more different outlets at once. The author has traced two of these former courses, which are marked by numerous

deposits of rounded pebbles. The one to the east of the existing river has evidently been the cause of the silting up of an aqueduct, constructed for supplying Aden with water. The peninsula of Aden, and the rocky promontory on the western side of the harbour, were doubtless islands at no remote period. Important changes in the coast-line have taken place on the west coast of Arabia. The deserted village of Muza, now 20 miles inland from Mocha, is referred to by ancient writers as one of the principal emporia of the maritime trade of Yemen. Several other places along the coast are also reported to have been formerly seaports, particularly the towns of Okchis and Zabid. The Wadi Alkabir no doubt aided greatly in connecting the rock of Aden with the sandy plain, by bringing down materials from the uplands, which were deposited in the quieter water under the lee of the main rocks and the various minor rocky islets, such as Aliyah and Jan Ali, which studded the sea in the locality.

AFRICA.

The Development of the Portuguese Possessions in South-East Africa.—After concluding the delimitation of the frontier between the South African Republic and the adjoining possessions of Portugal, the three commissioners of the latter separated at the confluence of the Pafuri with the Limpopo, reaching the coast by different routes in order to add as much as possible to the knowledge of the country south of the Sabi river. Captain de Andrade proceeded east to Mhambane, across the Ma-chengua plateau (traversed by previous travellers mainly from north to south); Captain Serrano being charged with the exploration of the Chengane, which carries the drainage of that plateau southwards to the Limpopo; while Major Xavier proceeded in a small boat down the latter river in order to study the possibilities of navigation on it. The last-named gives the result of his journey in the *Boletin* of the Lisbon Geographical Society (1894, No. 3), together with copious notes on the relations of the Portuguese government with the native tribes, and the steps necessary to bring about a more hopeful state of affairs than at present prevails. He divides the Limpopo, in its course within the Portuguese possessions, into three sections, the uppermost of which, extending over 186 miles down to the mouth of the Elephant river, cannot be navigated in the dry season, though for three or four months it can be traversed by small vessels such as ply upon the second section throughout the year, while for twenty days or more, at the highest flood, all the vessels which can cross the bar, could reach the frontier. The second section, 62 miles, extends to Mahamba, where the higher ground recedes from the banks and gives place to the thickly-peopled plain of fertile clayey soil known as Biléne, which extends to the sea. This section, together with the lower course of the Chengane, can be always navigated by stern-wheel steamers of slight draught. The third section, of 93 miles, has a minimum depth of from 3 to 8 feet according to the distance from the mouth. Of the minor streams, the Incomati, Motamba, and Inharrime are navigable in parts, and with a suitable system of cart-roads, which could be constructed at slight cost, the internal communication could be much improved in the interests of trade, without waiting for the slow and costly construction of a railway. The great desideratum in the relations with the native tribes is the display of sufficient force to uphold the Portuguese prestige as against the Vatua or Mangúni power. This race, which came from Zululand within recent years, has asserted its supremacy over the other tribes, who cannot be brought under the Portuguese influence unless the latter government is strong enough to protect them. Major Xavier urges the employment of European troops, reinforced by a native army, in order to bring Gungunyana to reason, and to allow of the occupation of suitable posts within his dominions. He does not at all favour

the cession of sovereign rights to companies, holding that, with good administration by government, the populous valley of the Limpopo should yield a sufficient revenue to do away with the colonial deficit. Most of the country south of the Sabi, except the Ma-chengue plateau, is adapted for the system of colonization under which planting is directed by Europeans, natives supplying the labour. This is the only one suited both to the climate of the country, and the resources of Portugal.

Journey of Counts Hoyos and Coudenhove in Somaliland.—This journey, which lasted from November, 1893, to March, 1894, was undertaken primarily for the purpose of sport, but additions were made to our knowledge of the topography of the country traversed by the carrying out of a route survey with watch and compass. An account of the journey appears in the *Mitteilungen* of the Vienna Geographical Society (vol. xxxvii. p. 337), accompanied by a large scale map constructed by Professor Paulitschke, in which the information supplied by other travellers, especially Colonel Paget and Captain Swayne, has also been utilized. The route of the Austrian travellers followed in the main the caravan track leading from Berbera to the south-west by Hargeisa or Little Harar, and thence *viâ* Milmil to the Webi Shabeyli, which was first traversed in 1891 by Baudi and Candeo, and subsequently by other travellers, and thus their work consists rather in the filling up of topographical details than of breaking new ground. They have, in particular, thrown new light on some of the northern tributaries of the Webi Shabeyli and on the topography of the country immediately to the south of that river, inhabited by the Aulihan, some of whose settlements were visited. From Berbera the country rises rapidly to the Somali plateau, falling more gradually to the south, in which direction it is cut up by the beds of streams, some of which contain a fair amount of water in the rainy season, and find their way to the Webi Shabeyli. The latter river where crossed was about 100 paces wide, and its banks were well wooded. Numerous mountain peaks and plateau-escarpments were observed from the route, profiles of which are given on the map. The conical peak of Doje, in particular, was visible from a long distance. Antelopes of various species were met with throughout, and lions, rhinoceros, giraffes, etc., in parts. The last-named, which are growing very scarce, were unsuccessfully followed on one or two occasions. From the furthest point reached a salt-mountain was reported to the south, named Spoda-Oldar, and beyond it the river Web flowed from west to east, uniting with the Ganana to the south-east. It thus seems, as remarked by Dr. Paulitschke, that these rivers have rather an easterly or south-easterly course than the southerly one assigned to them on the map in *Petermanns Mitteilungen* (1894, plate 9).

The Waziba Tribe, Central Africa.—In the *Mitt. aus d. Deutschen Schutzgeb.* (1894, part 1), Captain Hermann gives an account of the Waziba, the tribe which inhabits the western shore of the Victoria Nyanza, south of the Kagera river, and north of the Wazinja territories. To the west their district is separated from Karagwe (which nowhere touches the lake) partly by an uninhabited strip of country, and partly by Lake Urigi. It occupies a plateau which falls steeply in various directions, and is cut in two by the Ngono tributary of the Kagera. The greater part of the surface is covered by low bush and by banana plantations, which supply the chief food of the tribe. Although very moist (rain falling almost daily throughout the year), the climate is healthy and pleasant. The tribe has long lived in isolation, and although the name, under the form Kiziwa, together with those of some of the separate districts and of their chiefs, appeared in Stanley's map of 1878, little was known of it until the founding of the German station of Bukoba by Emin Pasha, shortly after which Father Schynse also gathered some information about it. The name is applied to the tribe generally by outsiders only, being

properly that of one of the five districts, under independent chiefs, into which it is divided. All of the latter, until the Germans appeared, owed allegiance to Uganda. The ruling families, with one exception, belong to the Wahuma or Watusi; but the bulk of the population, estimated by Captain Hermann at 150,000, have been settled in their present habitat from time immemorial. They are a well-developed and healthy race, tall and slim, with long narrow face, without the typical negro features. Their colour is an even "lamp-black." In speech they are very near the Wanyoro. Full details are given by Captain Hermann as to their dwellings, clothing, implements, customs, etc. The first named are of the beehive type, sometimes over 30 feet high, with a sort of covered porch before the doorway, which is the only aperture. European materials are little used as clothing, and although the caravan-track from Unyamwezi to Uganda and Unyoro leads through the country, it has been little touched by outside influences. Yet the people are intelligent and superior to other more favourably situated races. They have shown themselves well-disposed to the Germans, whose advent has done much to free them from the exactions of the Waganda.

Geology of South Algeria.—The extension of French influence into the extreme south of Algeria has given opportunities for the scientific examination of that country, of which advantage has been taken by Captain Almand, the officer commissioned to establish a fort at Hassi el Homeur, on the road from El Golea to Gurara. His attention has been directed in particular to the geology of the country, his notes on which have been communicated to the Paris Geographical Society (*vide* C. R. 1894, pp. 38, 166). His excursions to the plateau escarpment east of El Homeur, and to an isolated truncated cone, the Gara Kerbub, standing out from it, show that the limestones of the base are capped by calcareous and marly strata, of which the rocky surface of the plateau is composed. The flints and calcareous *débris* so covered the lower slopes, that it was with difficulty that the subjacent rock could be examined. Captain Almand has also carried out meteorological observations at El Homeur, and taken photographs of the surrounding country.

AMERICA.

Mr. Yule Oldham on the Early Discovery of America.—Although it cannot be said that the conclusions reached by Mr. Yule Oldham in his paper on this subject at the British Association met with general acceptance, there is no doubt that he has tapped a mine which may yield valuable results after further research, and has drawn attention to sources of information lately somewhat neglected. Mr. Yule Oldham has drawn his conclusions from an abbreviation of the map drawn by Andrea Bianco of Venice, and dated A.D. 1448. On this map are found for the first time the Portuguese discoveries near Cape Verd, which was rounded in 1445 by one of the Portuguese expeditions of Prince Henry the Navigator; and in addition to these there is drawn at the edge of the map, south-west from Cape Verd, a long stretch of coast-line labelled "Authentic Island," with a further statement that it stretches "1500 miles westward." In 'The Discoveries of the World,' published in the middle of the sixteenth century, Antonio Galvano says that in 1447 a Portuguese ship was carried by a great tempest far westwards until an island was discovered, from which gold was brought back to Portugal. Whether this amounts to actual evidence that the coast of Brazil was discovered in the year of Columbus' birth is another matter, and the meteorological and other difficulties are surely greater than Mr. Yule Oldham is inclined to suppose, but the point is of great interest.

AUSTRALASIA.

The Brandenburg Coast, New Guinea.—The separate name given to this part of the coast of German New Guinea by Dr. Otto Finsch (from whose diary a short note on it is given in *Petermanns Mitteilungen*, 1894, No. 3, with a map by P. Langhans), is justified by the fact that it is apparently the only part in which coconut palms occur in sufficient numbers to promise a paying export of *copra*. The coast forms the northern skirt of the Toricelli Range, whose highest point, the Hohenlohe-Langenburg peak, has a height of about 2950 feet. The streams which flow down from this range are not of great size. The coast as a whole is very thickly inhabited, especially where covered with coconut groves, beneath which most of the villages are concealed. The best copra district is in the neighbourhood of the Sainson Islands, which form the "Berlin Haven" discovered by Dr. Finsch. The spurs of the mountains are thickly wooded, some of the trees being of colossal size. In places, especially between the Albrecht river and the Sainson Islands, the forests skirt the shores, and, with the abundant water-power available, might repay the erection of saw-mills. On the Albrecht river and elsewhere tall casuarinas occur, which, from their resemblance to larches, give a European character to the landscape.

POLAR REGIONS.

Colonel Feilden on Current Polar Exploration.—The extraordinary fact that the fate of no less than four Arctic expeditions hung in the balance naturally caused Colonel Feilden's paper at the British Association on their comparative prospects to excite a great deal of interest. The experiences of the Wellman expedition have since become sufficiently familiar to us, and it is needless to do more than point out the remarkable manner in which Colonel Feilden's prophecies with regard to that enterprise have been fulfilled, and to express the hope that their fulfilment will add still greater weight to the words of warning he addressed to the public against encouraging even the boldest and bravest men to undertake Arctic exploration without first attaining the skill and knowledge of experience. Colonel Feilden discussed in some detail the prospects of Nansen's expedition, founding his belief in the general correctness of Nansen's views as to the Polar currents partly on the movements of the East Greenland ice, but chiefly on the drift wood stranded along the coast of Grinnell Land, north-west of Cape Union, and on the north coast of Greenland between Repulse Bay and Cape Britannia. From the observations made by himself during Sir George Nares' expedition, Colonel Feilden entertains no doubt that the vast quantities of wood have been brought from Siberia, and that at considerable speed, but the fact is by no means sufficient to ensure the success of the *Fram*, or to make her voyage anything but daring and hazardous in the extreme. We may, however, share fully in Colonel Feilden's confidence that, whatever happens to his vessel, Dr. Nansen's boldness and resource will bring his expedition safely back to civilization. With regard to the Jackson-Harmsworth expedition, Colonel Feilden thinks that the difficulties of Franz Josef Land would seem to have been rather underestimated. Although the route of Peary and Astrup is unlikely to lead to a favourable point from which to reach the Pole, the immense geographical importance of his work is undeniable. Colonel Feilden described most graphically his ascent with Sir George Nares of Mount Julia, and the view obtained from its summit. As the altitude was not less than 2000 feet, the view Polewards was probably as extensive as was that obtained by Lockwood, which was from a point apparently near sea-level, although 39 miles further north. The unbroken ice-pack stretched to the horizon, distant at least 50 miles, in lat. 83° 35′ N., and to the eastward, distant not less than 120 miles,

the northern points of Greenland about Cape Britannia were plainly seen. Colonel Feilden predicts that if Peary is successful in exploring the northern apex of Greenland, he will find the land ends somewhere between lat. 83° 35′ and 84°, and be there arrested by impassable ice. The chances of attaining the Pole with our present resources are but small at the best; probably the only hope lies in following the footsteps of Parry, near the meridian of North Spitzbergen.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Singular Bathymetric Phenomenon in the Lagoon of Venice.—Attention is called by O. Marinelli in the *Revista Geographica Italiana* (April, 1894) to a remarkable submarine trough which occurs in the Lagoon of Venice, just where the bank which separates the latter from the sea is broken by the Porto di Malamocco. While the neighbouring parts of the lagoon do not exceed 60 feet in depth, this depression, which occupies a very small area elongated in a direction parallel to the shore, reaches a depth of almost 164 feet, which is hardly equalled anywhere in the Adriatic north of a line joining the mouths of the Po with the southern points of Istria. The angle of slope of its borders is therefore exceedingly steep, amounting to about 45° on the eastern side. Other depressions occur in analogous positions in relation to the openings of the lagoon, but their depths are not to be compared with that of the first mentioned. The origin and persistence of this trough are alike difficult to explain. It can hardly be due solely to the action of currents, although these would be most active in the vicinity of channels leading to the sea. Nor is the explanation devoid of difficulties which would consider it a former sub-aerial hollow since submerged, and in any case the reason for its not having been filled by alluvial matter is obscure. In an editorial note, Dr. Pasanisi calls attention to other "submarine valleys," as they may well be called, some of which have been thought to be due to tectonic forces.

Recent Studies in Orography.—Two studies in the physical geography of mountain ranges, in its relation to the forces which have called them into existence, have lately appeared, one by M. E. Haug, dealing with the Alps, in the *Annales de Géographie* (1894, p. 150), the other on the Pyrenees, by MM. Schrader and de Margerie, as a reprint from the *Annuaire* of the French Alpine Club for 1892. In the light of the latest investigations into the morphology of various parts of the Alps, M. Haug endeavours to divide the whole range into natural regions, possessing a geographical unity, though based to a large extent on geological structure, and the process of folding which originated the range. The task is no easy one, owing to the difficulty of always satisfying the two requirements at once. Attempts to define the limits of locally recognized groups by the crests of ridges, or even by the courses of streams, have led to arbitrary subdivision. The basis of M. Haug's method is the occurrence of the various formations represented in longitudinal zones, the bounding lines between which are often clearly marked geographically by important longitudinal valleys, as (in part) those of the Isère, Upper Rhone, and Inn. The subdivision of these zones into geographical units is naturally more or less arbitrary. In the eastern Alps the arrangement is very simple, a central zone of crystalline schists being flanked north and south by calcareous ranges, with rocks of other character still further outwards, forming a continuous zone, however, only in the north. In the west the structure is much more complicated, and the writer here enters into a more minute examination of it. In the establishment of natural zones he to some extent follows M. Lory, one of the chief authorities on this part of the Alps, though differing from him in certain details. Besides the French sub-Alpine chains, M. Haug defines five zones, basing the division rather on the nature and direction of the folds than on the particular rocks at present on the surface,

the same traces of ancient dislocations being seen in the central crystalline *massifs* as in the sedimentary deposits which separate them, and which must have formerly covered them also. Thus the *massif* of Mont Blanc is considered by him to belong to the zone of calcareous ridges which stretch from Martigny to the Rhine, past the Lakes of Thun, Brienz, and Lucerne. Crystalline schists form a distinct zone (that of Monte Rosa) in the western as in the eastern Alps. The northern calcareous ranges are here included in three separate zones, while those to the south are entirely wanting. Of the zones established in the eastern Alps, only the most northern has any direct continuation in the west, all the others bending to the south-west between the Adige and Upper Rhine. In the region of the latter is a group of central *massifs*, which occupy a peculiar position from the north to south direction of their axes. It is here, therefore, that the scientific division of the range into an eastern and western half must be made, the last-named group being not of sufficient importance to form a subdivision of the first rank. The natural regions thus constituted, which are shown on a map accompanying the paper, do not coincide with those recognized by the popular nomenclature, the western part of the Bernese Alps, *e.g.* (west of Louéche), falling into a different zone from the rest of the group, and similarly in the case of others. The paper on the form and relief of the Pyrenees is accompanied by an excellent map, with contours 500 metres apart. The point which this brings out most clearly is the preponderance of the band, between 500 and 1000 metres (1640 and 3280 feet), consisting of tertiary strata, forming a sort of platform from which the central range rises. This feature, which belongs to the primeval structure of the range, is now most marked on the Spanish side, the tertiary strata having been largely removed by denudation towards France. On the former side it is bounded externally by a series of anticlinal ranges parallel to those in the central region. The different separate ranges of the latter (the Pyrenees proper) are disposed at various angles with the general direction of the chain (which is the resultant of the individual forces which have given rise to it), and the line of highest summits constantly diverges from that of the water parting. The salient feature in this seeming confusion is the predominance of folds with a direction E. 30° S., bending round towards the east-north-east. With regard to the features impressed by the action of running water, a great contrast exists between the two slopes. Towards France, where denudation has been more active, and especially at the Atlantic end, where the rainfall is greatest, transverse valleys are the rule, while to the south most of the rivers in part follow the direction of longitudinal folds, the valleys in some cases retaining the original form of the latter. Both the superficies and mass of the range have been greatly underestimated, through ignorance of the preponderating importance of the Spanish slope. The authors' calculations give 1195 metres (3920 feet) as the mean height. The portions below 1000 metres (3280 feet) form over three-fourths of the total mass, the highest summits contributing a comparatively insignificant amount.

Botanical Geography: Lectures in Paris.—The old Sorbonne at Paris is being rapidly transformed into a magnificent mass of buildings, wherein the various departments have ample accommodation and adequate appliances for carrying on research and teaching of the highest excellence. The Geographical department was ready some time ago, and at the beginning of last winter the new botanical laboratories and lecture-rooms were opened. Professor Bonnier inaugurated the session by a course of lectures on Botanical Geography, a subject never before treated at the Sorbonne. Professor Bonnier has done much to further an experimental study of many of the problems of geographical botany, especially in showing the influence of change of climate on plants. Too many botanists, when discussing

geographical botany, content themselves with giving the limits of the distribution of species, and a description of the plants in the different natural regions. Professor Bonnier, in his opening lecture, published in the *Annales de Géographie* for April, 1894, sketches his own more thorough methods. The nature of the plant, and the conditions under which it lives best, have much to do with its distribution. One plant flourishes in sandy soil and does not grow well in a limestone region; another appears in the salt lands near the sea, but does not prosper in the fresh clays of the interior. Climate is even more important than soil in determining distribution, and the leading factor in climate is temperature. There is a gradual transition from the olive groves of the Mediterranean to the mosses and lichens near he snow-line of the Alps or of Arctic lands. Secondary climate differences prevent the two series being exactly comparable: the moisture north receives more sunlight during summer than the very dry mountain-tops. The Alpine plant is very often a dwarfed variety of that of the plain, with reduced but thick leaves of intenser green, and flowers of stronger colour than its lowland relative, which it comes to resemble when transplanted to the plain. The ancestry of each plant and its habitat must be known before the distribution of the present species can be understood, and this study of vegetable palæontology leads up to the many intricate problems of the relation between present and past conditions of our globe. It is rarely possible to study the actual growth of a flora from the beginning, but the Krakatoa eruption left an island rising to about 2500 feet without vegetation. Soon the pumice was covered with fresh-water algæ, which, mixed with the *débris*, formed a soil where, three years after the eruption, Treub found ferns everywhere, but only a few flowering plants along the shore. The further study of the colonization of this virgin soil by plants promises results of much interest.

The Cruise of the "Princess Alice" in 1894.—To the Oxford meeting of the British Association, Mr. J. Y. Buchanan sent a paper on the cruise of the Prince of Monaco's yacht during the past summer. The programme with which the yacht started to work in the deep water between Gibraltar and the Azores had to be abandoned. Mr. Buchanan joined the yacht at Gibraltar on June 26. Observations were made in the narrowest part of the strait at distances of a mile apart from Ceuta to Gibraltar. The density of the samples showed that the water came mainly from the Atlantic. The superficial extent of the Atlantic water rapidly increases in going east, but the depth diminishes. When anchored off Tangier a typical example of the föhn wind was experienced, the average temperature of the air being 20° to 22° C., with puffs of 28° or 29°. Leaving Tangier on July 5, the yacht pursued a south-westerly course, sounding and dredging in depths of from 1500 to 4000 metres. Many interesting results were obtained, but unfortunately with the loss of much material. The Prince of Monaco has introduced improvements in apparatus, including a fine cord or cable of three strands, each of three fine galvanized steel wires, as a sounding-line. It is only 2·3 milimetres in diameter, with a breaking strain of 250 kilogrammes. This steel cord is much easier and safer to use than a single wire. The prince has also introduced the use of a modification of the lobster-pot at great depths with complete success. The baited pot is sunk and attached to a buoyed line, with a light attached to the buoys. The ship lies near for twenty-four hours, and when the trap is hauled up, the animals in it are found in perfect preservation. From the habit of one animal preying on a fellow-captive, small net cells are provided in the interior in which the smaller specimens may take refuge. One such pot put over in the Mediterranean in 2230 metres came up with eighty-nine black ground-sharks, a species previously considered exceedingly rare. The greatest depth to which this trap has been used is 3610 metres. Along the coast near Mogador the surface-temperature of the

water is lower than it is a few miles out at sea, as the result probably of the action of the north-east trade-winds causing an upwelling along the shore. The water along the shore is not only cold, but of a pure green colour, probably due to chlorophyll. During the fortnight spent in this region there was little wind, but a heavy swell, causing the ship to roll heavily. On July 21 the ship went out again after coaling at Gibraltar, and next day commenced working on the ridge discovered by the *Dacia* in 1883. Observations were made in the deep water north and south of the 50-fathom shoal, 600 miles south-west of the strait of Gibraltar, which showed that in the south channel at its deepest part the water from the surface to 110 fathoms was of Atlantic origin, but from that depth to the bottom (210 fathoms) it came from the Mediterranean, while a thin zone of mixed origin occurred between the two. In the north channel the Mediterranean water comes nearer the surface, but the proportion was practically the same. The sea-bed here and eastward toward the straits was everywhere rock. On July 27 the Gettysburg Bank, 360 miles due west of Gibraltar, was reached with a sounding of 185 metres, and the shoalest part found was 60 metres, or 33 fathoms. The ground was excessively rough; the lines attaching lobster-pots which had been put over to their buoys were repeatedly broken by the tidal current rubbing them against the rocks. A large number of fish was caught by the line on this shoal. Heavy weather prevented the observations from being continued, and the yacht returned to Lisbon, arriving on August 1. Off the Tagus the temperature of the surface water is comparatively low on account of the upwelling of cool water from great depths, a process of natural refrigeration very advantageous for the summer climate of that coast. The Tagus at Lisbon is practically pure sea-water renewed by the rapid tidal currents, and the river affects it little, except by rendering the surface muddy. On August 8 the *Princess Alice* sailed again to resume observations in the deep water north of the Burlings, which appears to be an isolated patch within the 100-fathom line descending to the depth of 900 fathoms. It was discovered by the Eastern Telegraph Company, on account of the trouble caused to their cables.

GENERAL.

Ice Control in Estuaries.—M. Maurice Dileos contributes to the April number of the *Revue Maritime et Coloniale* an interesting account of experiments on various methods of preventing the closing of navigation by ice in river-ports, docks, and estuaries, and of protecting vessels already enclosed. M. Dileos observes that rivers 10 to 25 feet in depth rarely freeze with temperatures higher than 5° Fahr. to 14° Fahr.; the Marne, Saône, Yonne, Loire, Meuse, and Seine never solidify with less than 22° to 25° of frost, although drift-ice is formed at 21° to 25° Fahr. in perfectly fresh water. Petroleum or other mineral oil is very effective in delaying congelation, but the danger of fire almost precludes its use. In tidal basins and docks the daily change of level is sufficient to break up the ice as long as the temperature remains much above zero, but with greater cold an ice-field is formed, which rises and falls with the tide. Once navigation is closed, efforts must be chiefly directed to preventing vessels being "nipped" or damaged by the movements of masses of ice in breaking up. M. Dileos shows that quite an extraordinary amount may be done by mechanical means alone in the way of clearing a channel, or at least a space round enclosed vessels. He also gives details as to the best means of laying down and igniting explosives. The results indicate great complexity in the effects produced on the ice directly and on the water underneath indirectly. It would seem that in inexperienced hands it is a comparatively simple matter to destroy a vessel and leave the surrounding ice-sheet almost intact.

OBITUARY.

The Right Honourable Sir Henry Austen Layard, G.C.B.

By Sir Frederic J. Goldsmid, K.C.S.I., C.B.

The death of Sir Henry Austen Layard, on July 5, in his seventy-eighth year, will have been noted with regret by others than his own countrymen. So prominent a diplomatist and so eminent an explorer could not fail to possess a European reputation; and the result of his labours in the department of archæological research alone must remain a rich legacy to the student of every nationality. He was born in Paris on March 5, 1817. His father, Mr. P. J. Layard, was son of Dr. Layard, Dean of Bristol. Originally intended to follow the legal profession, we find him attracted, in early life, towards pursuits of a less sedentary and restrictive character, and a long and important journey which he undertook in 1839 may be held to have determined his future career. The incidents of that journey were thus touched upon by the present writer, when reviewing the distinguished traveller's record of 'Early adventures in Persia, Susiana, and Babylon,' shortly after its publication in 1887:—

"The author's boyhood was passed in Italy, where he acquired a taste for the fine arts. At about sixteen he was sent to London to study law; and, after passing six years in the office of a solicitor and the chambers of 'an eminent conveyancer,' he formed the resolution of going to Ceylon to seek an opening at the Bar or in the Civil Service. A travelling companion was found for him in the person of Mr. Edward Ledwich Mitford, a gentleman some ten years his senior, who disliked sea-voyages, but was prepared to make any ventures by land. The two agreed to proceed together through Central Europe, Dalmatia, Montenegro, Albania, and Bulgaria to Constantinople; thence to cross Asia Minor to Syria and Palestine, continuing the journey eastward to Baghdad, from which city they believed they 'should be able to reach India through Persia and Afghanistan, and ultimately Colombo.' No ship or steamer was to be resorted to; all was to be *bonâ fide* land travel, 'except when passing over the narrow strait of Adam's Bridge.'

"The programme was not carried out as intended. The travellers left London in July, 1839. On the way Layard caught a fever, which developed at Constantinople into a gastric attack, and compelled him to keep his bed. After a course of sharp treatment, he recovered sufficiently to overtake his comrade at Mudania, south of the Sea of Marmora, but by boat. This deviation from the original plan of procedure was followed by a second temporary separation, for though they proceeded together to Jerusalem, Layard, on January 15, 1840, started alone for Petra, and did not rejoin Mitford until some few weeks later at Aleppo. Hence on March 18 they journeyed in company to Baghdad, arriving there on May 2. On June 2—pronounced by a Mulla, after consulting the Koran, to be a profitable day for commencing a journey—they joined a caravan outside the gates, and would have made their first march towards the Turco-Persian frontier, but a muleteer's wrangle, in which the 'Karwán-Báshi' was himself the principal performer, detained them near the city walls, and they did not fairly get away till the day following. Reaching Hamadan (Ecbatana) by the usual road through Karmánshah and Kangawár, they were kept in that town for nearly a month, owing to difficulties about the *firmán* requisite to enable them to follow their route eastward. Eventually, when the obstacles were removed, they were no longer to travel together, a new and this time permanent separation taking place. On August 8 they rode out to the village of Shaverin, where they dined with some French officers, and parted company—Mitford to take a long journey through the north of Persia to

Kandahar and India; Layard to return to Hamadan and make fresh attempts to find a passage through Eastern Persia into Sistan, and so on to the track of the other.

"Sir Henry's book may thus be divided into two parts: the first and shorter descriptive of his wanderings in Palestine and Syria during a temporary separation from his fellow-traveller; the second and longer relating his experiences in Ispahan and Central Persia, Susiana, the country of the Bakhtiyáris, and Turkish Arabia, when left to his own resources. A supplementary section may be added for the last two chapters, which bring events up to 1845, and treat of employment at Constantinople and in the provinces of European Turkey. It should be noted that the author purposely avoids narrating any joint adventures, on the plea that such narrative has been forestalled by Mr. Mitford's publication of his 'Land March from England to Ceylon.' . . . As for the original project of finding his way overland to India, he does not seem to have abandoned it until revisiting Baghdad in 1842, when the receipt of letters from England led him to turn his thoughts homeward. He had then written his memoir on Khuzistan, describing the country, inhabitants, and resources, with a view to showing the importance of establishing political and commercial relations with it; and he had induced an enterprising British merchant, established at Baghdad, 'to enter into communication . . . with some of the principal landowners of Shuster,' so as to bring about, if possible, an exchange of native local products with British manufactures. . . . From Hamadan, after Mr. Mitford's departure, Layard proceeded to Ispahan. He had hoped to avoid the usual road and keep close to the great hill range of Luristan, and at Burujird he had proposed to strike across the Bakhtiyári mountains to Shuster; but sickness and various other obstacles prevented the fulfilment of his wishes, and he was compelled to turn eastward and seek a more direct road through the Feridun district and Tehrun. At one village he had found a Georgian Christian colony established by Shah Abbás. The inhabitants had retained their native language and religion; their features differed from those of the surrounding populations; their women went unveiled, and many were 'strikingly handsome;' their gardens and orchards had a prosperous appearance. In another Christian village, Adun, the inconvenience he underwent from the curiosity of the native community leads our author to contrast their behaviour unfavourably with that of Musalmans. 'This may arise,' he says, 'from the inferior position which they hold, and from the ill treatment they have experienced for so many generations from their Mohammedan rulers.' At Ispahan Layard, suffering, on first arrival, from severe ague and dysentery, was hospitably received by, and remained for some days the guest of, M. Eugène Boré, a French gentleman and an accomplished Oriental scholar. That he afterwards removed his quarters to a 'ruined house' occupied by Mr. Burgess, an English merchant of Tabriz, must be attributed as much to the political complications of the day as to personal susceptibility. In any case he was detained, owing to the customary dilatoriness and evasions of Persian authorities and executives, for some five weeks before again resuming his journey.

"The murder of Dr. Forbes in Sistan had at this time become known at Ispahan, and the Mu'tamadu'd-daulah, then governor there, would not hear of an English traveller moving, with his authority, in that direction. There was no alternative, therefore, but to revert to the Shuster project. How this was put into execution, and the journeys that followed, will be found related in the eighth and remaining chapters of this book. Up to the point reached, indeed, there is no lack of romantic adventure. Further on the narrative may be said to bristle with exciting incident, and the narrator's life seems to have hung by a thread at many periods of his eventful history. He is in peril from robbers, treachery, sickness,

wild beasts; he is robbed of horses, clothes, money; he is in prison, in want, undergoing sore trials, moral and physical." *

We have here sketched out Layard's first contributions to geographical knowledge in respect of Asiatic countries; but of the lands which he visited west of the Bosphorus, we can do no more than call attention to their names. These, however, will serve to indicate the extent of his wanderings. The two charming volumes to which our notice refers, although published in comparatively recent years—when the subject treated in their pages had grown old—were received with more than common favour by the many, and with grateful satisfaction by the few readers under whose review they came. They well deserve a conspicuous place in the higher-class books of travel. Later on, in 1842, after a rough experience of living among Arabs, Turks, Kurds, and Persians, Layard appeared at Constantinople, the bearer of despatches from H.M. Consul at Baghdad to H.M. Ambassador at the Porte, then Sir Stratford Canning. The latter, whose keen appreciation of character was not the least remarkable of his great diplomatic qualifications, was not long in utilizing the capacities of the new-comer, whose knowledge of the many tracts he had lately traversed rendered him an exceptionally capable adviser and referee on questions arising out of Oriental problems of the day. Among these was the definition of the disputed Turco-Persian frontier, to effect which an International Commission had been organized—the means of settling an untoward feud, designed and put in execution by our representative in Turkey. It was the ambassador's wish to recognize the services of his quasi-improvised assistant by the offer of an *attaché*-ship on his staff, but the measure was apparently distasteful to the Foreign Office; and in 1845 Layard was despatched—with such funds as his enlightened patron could get together, and supported by *firmáns* such as no foreign diplomatist was more likely than Sir Stratford Canning, from sheer personal influence, to obtain—to carry out the exploration of the site of Ancient Nineveh, according to the general outline of operations sketched by himself, on personal examination of the ground in the neighbourhood of Mosul. In the following year, the British Ambassador's *employé* was authorized to excavate, and export sculptures. His annual pay and current expenditure were provided out of the private resources of his chief.

Rarely has a salary of £200 per annum been more thoroughly and legitimately earned. After a brilliant campaign of archæological discovery, Layard returned to Europe in 1847, with a report of proceedings of so full and interesting a kind as to give him deserved celebrity, not only among his own countrymen, but throughout continental nations. Oxford at once acknowledged his work by conferring upon him the honorary degree of D.C.L. Even Downing Street relented towards him so far as to open, for his admission, a door into the *salons* of diplomacy; for, in the words of the Foreign Office List, he became "an unpaid *attaché* to the Embassy at Constantinople from November 2, 1847, to March 20, 1849," and received a nomination to accompany (though he did not actually join) Colonel Fenwick Williams to Erzerum, "while engaged in carrying out the details of the Turco-Persian Boundary Treaty." On April 5, 1849, we learn from the same source, he was appointed fifth-class paid *attaché* at Constantinople, "to enable him to carry out his researches in the valley of the Tigris, which appointment he held till February 11, 1852."

From this period, up to the day of his death—more than forty years—the record of his career may be understood from an enumeration of the official posts filled and honours received. He was elected Lord Rector of Aberdeen University in 1852, and sat as Member for Aylesbury from July, 1852, till March, 1857. Under-

* *Athenæum*, December 24, 1887.

Secretary of State for Foreign Affairs for a few days in 1852, he was reappointed to that office in 1861, remaining in it until July, 1866. He was elected Member for Southwark in December, 1860, and re-elected November, 1868, in which latter year he was sworn a Privy Councillor, and made First Commissioner of Works and Buildings. In 1869 he was appointed Envoy Extraordinary and Minister Plenipotentiary at Madrid, and Special Ambassador at Constantinople *ad interim* in March, 1877. Later in this same year, he was appointed Ambassador Extraordinary and Plenipotentiary to the Sultan, receiving the Grand Cross of the Bath in the following March. In 1880 he retired from public life, and took up his residence at Venice, there to indulge those artistic tastes which he, from time to time, successfully displayed in contributions to art and literature. His best-known works, however, will always remain: 'Nineveh and its Remains;' 'Discoveries in the Ruins of Nineveh and Babylon;' 'The Two Series of the Monuments of Nineveh;' and the recollections of travel to which lengthy allusion has been made.

Perhaps no better tribute could be offered to Sir Henry Layard's memory than the following quotation from the *Quarterly Review* of January, 1849, when his early discoveries had been first known and appreciated by his countrymen at home: "We found in Mr. Layard, not merely an industrious and persevering discoverer in this new field of antiquities, but an Eastern traveller, distinguished we may say, beyond almost all others, by the freshness, vigour, and simplicity of his narrative; by an extraordinary familiarity with the habits and manners of these wild tribes, which might seem almost intuitive, but is, we soon perceive, the result of long and intimate acquaintance, and perfect command of the language. No one has shown in an equal degree the power of adapting himself—at once and completely, without surrendering the acknowledged superiority of the Frank—to the ordinary life of the Asiatic. Mr. Layard, without effort, teaches us more, and in a more light and picturesque manner, even than d'Arvieux. He seems as trustworthy, though far more lively and dramatic, than Burckhardt. It is hardly too much to say that the history of the excavations and revelations of his management of the Turkish rulers, of the wild chiefs whom the intelligence of his strange proceedings brought around him, of the labouring Arabs and Chaldeans whom he employed in his works, and the removal of the sculptures, with their embarkation on the Tigris, is as interesting as the discoveries themselves; while, during the necessary suspension of his toil among the ruins, we are content to follow him into the villages of Mohammedans, Nestorian Christians, devil-worshippers, as if these were the sole or primary object of his travels."

Rev. Edward Hale.

It is with much regret that we record the death of the Rev. Edward Hale, Senior Assistant Master at Eton College; it took place on July 25. Mr. Hale, who was sixty-six years of age, graduated at Emmanuel College, Cambridge, taking his B.A. degree in 1850. About the same year he was appointed Assistant Mathematical Master at Eton. Mr. Hale proceeded to M.A. in 1853, and eventually quitted the Mathematical School and became Science Master. Mr. Hale all along took a special interest in geography, and did what he could to give it a place at Eton, where it is recognized in the science examinations. He gave material advice and assistance to the Council of the Society (of which he was a Fellow for many years) in their efforts to raise the standard of geography in England, and promote its recognition in education. Mr. Hale was a man of the most genial disposition, and his death will be felt as a loss by all who knew him.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full :—

A. = Academy, Academie, Akademie.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce, Commercial.
C. R. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
J. = Journal.
M. = Mitteilungen.
Mag. = Magazine.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue, Revista.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

EUROPE.

Astronomical Positions. **Weiss and Schramm.**

Astronomische Arbeiten des k. k. Gradmessungs—Bureau. Ausgeführt . . . von Prof. Dr. Edmund Weiss und Dr. Robert Schramm. V. Band. Längenbestimmungen. Vienna, F. Tempsky, 1893. Size 12½ × 10, pp. 190.

The difference in longitude between the centres of the domes of the Observatories in Vienna and Berlin is fixed as $11^m\ 46{\cdot}489^s$, and that between the centre of the Berlin Observatory dome and the centre of the Greenwich Observatory transit instrument as $53^m\ 34{\cdot}893^s + 0{\cdot}018$.

Austria—Tyrol. **Ogilvie.**

Coral in the "Dolomites" of South Tyrol. By Miss Maria M. Ogilvie, D.Sc. [Extracted from the *Geological Magazine*, Decade iv. vol. i. Nos. 355–356, January and February, 1894.] Size 8½ × 5½, pp. 22. *Map and Diagrams. Presented by the Author.*

Miss Ogilvie finds that the evidence afforded by the fossil corals of the Dolomites tends to support Murray's theory of the origin of reefs rather than Darwin's. Beyond a description of the typical scenery of the district, Miss Ogilvie's paper is strictly geological, and in some respects controversial.

Azores. **Kettle.**

A Description of the Azores or Western Islands. To accompany the Chart. Fifteenth Edition. By William R. Kettle. London, R. H. Laurie, 1894. Size 8½ × 5½. *Presented by the Author.*

An excerpt from Findlay's 'Memoir of the North Atlantic Ocean.'

European Predominance. **Reclus.**

Elisée Reclus. Hégémonie de l'Europe. Edition de la Société nouvelle. 1894. Size 9½ × 6, pp. 13. *Presented by the Author.*

A discussion of the geographical reasons why Europe has gained and maintained its pre-eminence as the home of civilized man.

France—Meurthe-et-Moselle. **Bleicher.**

Le Minerai de Fer de Meurthe-et-Moselle, par M. Bleicher. Extrait du Bulletin de la Société industrielle de l'Est. Nancy, Berger-Levrault & Co., 1894. Size 10 × 6½, pp. 22. *Map and Plates. Presented by the Author.*

France—Paris. **Baedeker.**

Paris and Environs, with routes from London to Paris. Handbook for Travellers. With 12 Maps and 33 Plans. Eleventh revised Edition. Leipsic, Karl Baedeker. London, Dulau & Co., 1894. Size 6½ × 4½, pp. xl., 396, and 32. *Price 6 marks. Presented by Messrs. Dulau & Co.*

France—Vichy. **Dollfus**

Récherches géologiques sur les environs de Vichy (Allier). Par Gustave F. Dollfus. Paris, Comptoir Géologique de Paris, 1894. Size 11 × 7, pp. 65. *Plates. Price* 3 *fr.*

Germany. **Penck.**

Bericht der Central-Kommission für wissenschaftliche Landeskunde von Deutschland über die zwei Geschäftsjahre von Ostern, 1891 bis Ostern, 1893 von Prof. Dr. Albrecht Penck in Wien (Sonder Abdruck aus den Verhandlungen des X. Deutschen Geographentages in Stuttgart, 1893). Size 9½ × 6½, pp. 22. *Presented by the Author.*

Germany—Fichtelgebirge. **Lord.**

Ueber die Basalte des Fichtelgebirges. Inaugural-Dissertation zur Erlangung der Doktorwürde der hohen naturwissenschaftlich-mathematischen Fakultät der Ruprecht-Karls-Universität zu Heidelberg, vorgelegt von Edwin C. E. Lord aus Brooklyn-Heidelberg, 1894. Size 9 × 6, pp. 36. *Presented by the Author.*

Germany—Prussia. *Petermanns M.* **40** (1894): 160–165. **Supan.**

Die Nationalitäten der preussischen Monarchie nach der Zählung von 1890. Von Prof. Dr. A. Supan. *With Map.*

Iberian Peninsula. **Penck.**

Die Pyrenäen-Halbinsel. Reisebilder. Vortrag, gehalten den 8 November, 1893, von Albrecht Penck (Vorträge des Vereines zur Verbreitung naturwissenschaftlicher Kenntnisse in Wien xxxiv. Jahrgang Heft 1). Wien, 1894. Size 7½ × 5, pp. 40. *Presented by the Author.*

Lake of Constance. **Penck.**

Bericht über die Exkursion des X. Deutschen Geographentages nach Ober-Schwaben und dem Bodensee (10–14 April, 1893). Unter Mitwirkung von Eduard Brückner, Hermann Credner, E. Schuhmacher und Hans Thürach. Verfasst von Albrecht Penck, in Wien. (Sonderabdruck aus den Verhandlungen, etc.) Berlin, 1893. Size 9½ × 6½, pp. 10. *Presented by Professor Penck.*

Scotland—Northern Highlands. **Baddeley.**

Thorough Guide Series. The Northern Highlands (Scotland, Part II.), containing a full description of Aberdeen, Inverness, Loch Maree, and Gairloch, and of the mainland north of those places in the counties of Aberdeen, Banff, Elgin, and Nairn, Inverness, Ross, Cromarty, Sutherland, and Caithness. By M. J. B. Baddeley. Fifth edit. London, Dulau & Co., 1894. Size 6½ × 4½, pp. xix. and 145. *Maps and Plans. Price* 3*s.* 6*d. Presented by the Publishers.*

Switzerland—Basel. **Hotz.**

Basels Lage und ihr Einfluss auf die Entwicklung und die Geschichte der Stadt, von Dr. Rud. Hotz. Wissenschaftliche Beilage zum Bericht über das Gymnasium Schuljahr, 1893–94. Basel, 1894. Size 11½ × 9, pp. 28.

This memoir will receive special notice.

ASIA.

Chinese Atlas. *Riv. G. Italiana* **1** (1894): 417–422. ——

Cartografia dell' estremo Oriente. Un Atlante Cinese della Magliabechiana di Firenze, per Bernardino Frescura ed Assunto Mori.

Dutch East Indies. **Van der Chijs.**

Nederlandsch-Indisch Plakaatboek, 1602–1811, door Mr. J. A. Van der Chijs. Elfde Deel, 1788–1794. Batavia, 1893. Size 8½ × 5½, pp. 903.

Dutch East Indies. **Van der Chijs.**

Dagh-Register gehouden int Casteel Batavia vant passerende daer ter plaetse als over geheel Nederlandts-India, Anno 1664. Uitgegeven door het Bataviaasch Genootschap van Kunsten en Wetenschappen, met medewerking van de Nederlandsch-Indische Regeering en onder toezicht van Mr. J. A. Van der Chijs. Batavia, 1893. Size 11 × 7½, pp. 632.

India—Amritsar District.

Gazetteer of the Amritsar District, 1892-93. Revised Edition. Compiled and published under the authority of the Punjab Government. Size 10 × 6½, pp. viii., 172, and xlvi. *Presented by the Secretary of State for India.*

This gives a thoroughly revised and largely rewritten account of the Amritsar district, dealing with all the geographical and economical conditions of the region.

India—Gohna Lake. *Records Geol. Surv. India* **27** (1894): 55-64. **Holland.**

Report on the Gohna Landslip, Garhwal. By Thomas H. Holland.

This report, which is well illustrated with photographs and diagrams, was noticed in the *Journal* for August, vol. iii. p. 162.

India—Waterworks. **Clerke, Sadasewjee, Jacob.**

Min. P.I. Civil Engineers **115** (1894): 12-62.

The Tansa Works for the Water-Supply of Bombay. By W. J. B. Clerke.
The Baroda Waterworks. By J. Sadasewjee.
The Water-Supply of Jeypore, Rajputana. By Colonel S. S. Jacob.

These papers, which are illustrated by diagrams and some views, are of special interest on account of the peculiar difficulties which have to be overcome in taking advantage of the brief rainy season for collecting and in contending against evaporation during the storage and transport of the water.

Indian Marine Surveys. **Oldham.**

Administration Report of the Maritime Survey of India for the official year 1893-94. By Commander Cecil F. Oldham, R.N. Bombay, 1894. Size 13½ × 8½, pp. 14. *Presented by the Marine Survey of India.*

The work recorded in this report will be referred to in a special note.

Kalyani Inscriptions. **Sein-Ko.**

A Preliminary Study of the Kalyani Inscriptions of Dhammacheti, 1476 A.D. By Taw Sein-Ko. Reprinted from the *Indian Antiquary*. Bombay, 1893. Size 11½ × 9, pp. 60. *Plates.*

Malay Archipelago. *B.G.S. California* **2** (1894): 13-42. **Everill.**

The Malay Archipelago. By Captain Henry Chas. Everill. *Illustrations.*

Malay Archipelago—Java. **Bastian.**

Indonesien oder die Inseln des Malayischen Archipel, von A. Bastian. V. Lieferung, Java und Schluss. Berlin, J. Dümmler, 1894. Size 10½ × 7, pp. vii. and 135. *Plates.*

This concludes Professor Bastian's latest work on the Malay Archipelago, giving an account of the history of the archipelago, especially Java, and of the religious changes, illustrated by the reproduction of a series of ancient paintings.

Malay Archipelago—Sumatra. **Brenner.**

Besuch bei den Kannibalen Sumatras. Erste Durchquerung der unabhängigen Batak-Lande von Joachim Freiherr von Brenner. Würzburg, Leo Woerl, 1894. Size 11 × 7½, pp. iv. and 388. *Price* 10*s*. *Maps and Illustrations.*

A valuable work which will be separately noticed.

Russian Central Asia. *Ann. G.* **3** (1894): 346-370, 467-488. **Blanc.**

La Colonisation russe en Asie centrale, par M. E. Blanc.

An account of Russian enterprise in the trans-Caspian district, with particulars of the efforts being made to promote irrigation agriculture, especially cotton-growing in Turkistan.

Sinaitic Peninsula. *Le Globe* **33** (1894): 99-125. **Ehni**

Souvenirs du Mont Hôr et des ruines de Petra, par M. Jacques Ehni, Dr. Phil.

Siberia. **Martin.**

En resa i vestra Sibirien utford år 1891 med understöd af Vegastipendiet af J. R. Martin. [From *Ymer*, 1892.] Size 9 × 6½, pp. 70. *Presented by the Author.*

Tibet. **Marston.**

The Great Closed Land. A Plea for Tibet. By Annie W. Marston, with Preface by Rev. B. La Trobe. London, S. W. Partridge & Co., n.d. [1894]. Size 9 × 7½, pp. 112. *Map and Illustrations.*

This volume is written mainly with the object of arousing Christian sympathy for Tibet. Chapter I. contains a brief account of the attempts of various travellers to enter the land; succeeding chapters deal with the country, its government, the people, and their religions, and the efforts made by various missionary bodies to settle in the country.

AFRICA.

Egypt—Nile. *J.R.I. British Architects* (3) **1** (1894): 573–582. **Whitehouse.**

Nile Reservoirs: the Fayoum and Rayan-Moeris. By Mr. Cope Whitehouse.

A richly illustrated paper pointing out the defects of the Nile reservoir scheme, and the various advantages of a reservoir in the Wady Rayan.

Egypt—Wady Rayan. **Schweinfurth.**

Translation of a Note by Dr. Schweinfurth on the Salt in the Wady Rayan. Size 13 × 9½, pp. 9.

Egyptian Dialects. **Seidel.**

Praktisches Handbuch der Arabischen Umgangssprache ägyptischen Dialekts. Mit zahlreichen Uebungsstücken und einem ausführlichen ägyptoarabisch-deutschen Wörterbuch, von A. Seidel. Berlin, Gergonne & Cie. [1894]. Size 9½ × 6, pp. vi. and 310. *Presented by the Publishers.*

A handbook of the dialect of Arabic spoken in Egypt, arranged in a practical manner as an aid to the acquisition of the language by students, containing a grammar, reading exercises, and vocabulary; the Arabic words are given in Roman type.

French Sudan. *Quarterly R.* **179** (1894): 264–287. ——

The French Sudan.

This article gives a clear summary of the history and progress of French influence in the western Sudan.

Liberia. *Ann. G.* **3** (1894): 489–498. **Rouire.**

Délimitation de la Républiqụe de Libéria. Par M. C. Dr. Rouire.

An account of the changes in area of Liberia, illustrated by a map showing the present outline of the colony and its successive restrictions in area. The paper is followed by a bibliography of Liberia.

North Africa. **Rainaud.**

Quid de Natura et fructibus Cyrenaicæ Pentapolis Antiqua Monumenta cum recentioribus collata nobis tradiderint. Thesim facultati litterarum Parisiensi proponebat A. Rainaud. Paris, A. Colin, 1894. Size 10 × 6½, pp. 138. *Map. Presented by the Author.*

Somali-land. *M.G. Ges. Wien.* **37** (1894): 337–383. **Hoyos.**

Meine und Graf Richard Coudenhove's Reise nach dem Somali-Lande. Von Ernst Graf Hoyos, jun.

This paper is referred to in the Monthly Record.

NORTH AMERICA.

Alaska. **Klotz.**

Alaska. By Otto J. Klotz, of the Alaska Boundary Survey. Reprinted from the *Ottawa Naturalist* for April, 1894. Size 9 × 6, pp. 28. *Presented by the Author.*

A popular general sketch.

Canada. **Baedeker.**

The Dominion of Canada, with Newfoundland and an excursion to Alaska. Handbook for Travellers. By Karl Baedeker. Leipsic, Karl Baedeker. London, Dulau & Co. Size 6½ × 4½, pp. lxii. and 254. *Maps. Price 5s. Presented by Messrs. Dulau & Co.*

Mr. J. T. Muirhead, who last year wrote 'Baedeker's Handbook to the United States,' has now produced a very compact guide to Canada which cannot fail to be of the greatest service to tourists, who have learned to like and trust these handbooks. There is a plentiful supply of maps, and excellent introductory matter by good authorities on the geography, history, and institutions of Canada.

Canada—Hudson Bay. **Schultz.**

Transaction No. 47, The Historical and Scientific Society of Manitoba. A Forgotten Northern Fortress. By Hon. John Schultz. Winnipeg, 1894. Size 9 × 6, pp. 14. *Map and Illustrations. Presented by the above Society.*

A history and description of Fort Prince of Wales, Churchill Harbour, Hudson Bay.

Canada—Manitoba. **Bryce.**

Transaction No. 46, The Historical and Scientific Society of Manitoba. Early Days in Winnipeg. By George Bryce, LL.D. Winnipeg, 1894. Size 9 × 6, pp. 8. *Illustrations. Presented by the above Society.*

Contains sketches of Winnipeg in 1869 and in 1871.

Manitoba. **Schultz.**

Transaction No. 45, The Historical and Scientific Society of Manitoba. The Old Crow-Wing Trail. By Hon. John Schultz, M.D. Winnipeg, 1894. Size 8½ × 6, pp. 32. *Illustrations. Presented by the Historical and Scientific Society of Manitoba.*

An account of the old Crow-wing route to Fort Garry (Winnipeg) from St. Paul (Minnesota), which has now been obliterated by the cultivation of the country, but was traversed by Dr. Schultz in 1860. The paper contains views of Winnipeg in 1860 and at the present day.

Mississippi Valley. *Report Smithsonian I.* **1891** (1893): 503–599. **Carr.**

The Mounds of the Mississippi Valley historically considered. By Lucien Carr.

This is reprinted from the *Memoirs* of the Kentucky Geological Survey, vol. ii., 1883.

United States. **Ratzel.**

Die Vereinigten Staaten von Amerika. Von Dr. Friedrich Ratzel. Zweiter Band. Politische und Wirtschafts-Geographie. Zweite Auflage. München, R. Oldenbourg, 1893. Size 10 × 7, pp. xiv. and 763. *Map. Price* 15*s.*

This volume deals with the economic geography of the United States, treating of the land with regard to elevation, soil, and climate; of the people—especially the effects of the juxtaposition of different races—the distribution and movements of population, the resources of the country in agricultural produce, minerals, manufactures, and means of transport and external trade. Finally, the government, religions, intellectual, and social life of the people are considered in a series of chapters.

United States—California. **Lawson.**

The Post-Pliocene Diastrophism of the Coast of Southern California. By Andrew C. Lawson. University of California, Bulletin of the Department of Geology. Vol. i. No. 4, pp. 115–160, pls. 8–9. Berkeley, 1893. Size 10½ × 7.

United States—California—Point Bonita. **Ransome.**

The Eruptive Rocks of Point Bonita. By J. Leslie Ransome. University of California, *Bulletin* of the Department of Geology. Vol. i. No. 3, pp. 71–114, pls. 6–7. Berkeley, 1893. Size 10½ × 7.

Point Bonita forms the southern extremity of Marin County, California, being the most westerly headland on the north shore of the entrance to San Francisco Bay.

CENTRAL AND SOUTH AMERICA.

Argentine—Cordoba. *B.A. nacional Ciencias, Cordoba* **12** (1890): 5–54 **Bodenbender.**

La Cuenca del Valle del Rio 1° en Córdoba. Descripcion geologica del Valle del Rio 1° desde la Sierra de Córdoba hasta la Mar Chiquita, por Guillermo Bodenbender.

The memoir is illustrated by a geological map of the river valley and a series of sections printed in colours.

Central American Place-Names. *Globus* **66** (1894): 90–96. **Sapper.**

Indianischer Ortsnamen im nördlichen Mittelamerika. Von Dr. Karl Sapper, Coban.

This paper on place-names in Central America will be separately noticed. It is accompanied by a map showing the limits within which place-names belonging to the different native languages are found.

Chile—Tarapaca. **Billinghurst.**

La Irrigación en Tarapacá, por Guillermo E. Billinghurst. Santiago de Chile, 1893. Size 10½ × 7, pp. 193. *Maps and Plates.*

Colombia. **Reclus and Vergara.**

Eliseo Reclus. Colombia. Traducida y anotada con autorizacion del Autor por F. J. Vergara y Velasco. Edicion oficial. Bogota, 1893. Size 8½ × 5½, pp. xxxii. and 440. *Presented by the Author.*

This is a Spanish translation with additions and notes of the chapter on Colombia in the last volume of Reclus' *Geographie Universelle*, but unaccompanied by illustrations, and with a very poor sketch by way of apology for a map.

Dutch Guiana. *Tijdschr. Nederlandsch. Aardrijksk. Genoots.* **10** (1893): 73–87. **Loth.**

Verslag van eene reis naar de Lawa tot het verkennen van het terrein tusschen die rivier en de Tapanahoni en van dat tusschen de Toso- en de Sara-kreek, gedaan van Januari tot Mei, 1892. Door W. L. Loth. *With Map.*

Guatemala. ———

Demarcación politica de la República de Guatemala. Compilada por la Oficina de Estadística, 1892. Guatemala, 1893. Size 10½ × 7, separately paged. *Presented by the Government of Guatemala.*

A useful book of reference containing particulars of all the political divisions and subdivisions of Guatemala, and, which is most valuable, an alphabetical list extending to 147 pages of all the place-names in the Republic.

South America—East Coast. ———

No. 88. U.S. Hydrographic Office. East Coast of South America, from the Orinoco River to Cape Virgins, including Falkland, South Georgia, Sandwich, and South Shetland Islands. Second Edition. Washington, 1894. Size 9 × 6, pp. ix. and 492, index chart. *Presented by the U.S. Hydrographic Office.*

Venezuela—La Guaira. **Punchard and Houston.**

Min. P.I. Civil Engineers **115** (1894): 332–342.

La Guaira Harbour Works. By William Charles Punchard and James Lennox Houston.

AUSTRALASIA.

Aborigines. **Cunow.**

Die Verwandtschafts-Organisationen der Australneger. Ein Beitrag zur Entwicklungsgeschichte der Familie, von Heinrich Cunow. Stuttgart, J. H. W. Dietz, 1894. Size 10½ × 6½, pp. viii. and 190. *Presented by the Author.*

Primitive peoples like the Australian aborigines reveal so many of the first impulses and processes of the growth of civilization, that it is very important to subject their manners and customs to the closest scientific scrutiny before the effacing influences of contact with outsiders has done its work. The author treats of the origin and development of the clan system and of the various social divisions and theory of kinship in different Australian tribes, comparing them with other primitive peoples, and critically considering the bearing of the facts he has elucidated on various anthropological theories.

Australia—Artesian wells. *J. & P.R.S. New South Wales* **27** (1893): 408–442. **David.**

Notes on Artesian Water in New South Wales and Queensland (Part II.). By Prof. T. W. E. David.

In the same journal (pp. 466–468) there is a paper by Mr. W. A. Dixon on "Artesian Water in Connection with Irrigation."

Australian Handbook. **Gordon and Gotch.**

The Australian Handbook (incorporating New Zealand, Fiji, and New Guinea), Shippers' and Importers' Directory and Business Guide for 1894. London, Gordon and Gotch, 1894. Size 10 × 6½, pp. 624. *Maps, Plans, and Plates.*

The value of this standard Year-Book is so well understood that it is sufficient to note the fact that the present is the twenty-fifth annual publication.

Dutch New Guinea. **Clercq.**

Tijdschr. Nederlandsch. Aardrijksk. Genoot. **10** (1893): 151-219, 438-465, 587-649, 841-884, 981-1021.

De West-en Noordkust van Nederlandsch Nieu-Guinea. Proeve van beschrijving volgens de Mededeelingen en rapporten van reizigers en Ambtenaren en naar eigen Ervaringen. Door F. S. A. de Clercq.

An authoritative account of recent occurrences in Dutch New Guinea, serving as a supplement to Robidé van der Aa's great work, which was published in 1879. A map of the north-west part of New Guinea and sketch-maps of parts of the territory are given, as well as views. Full descriptions of people and language, taken by districts, form a considerable proportion of the work. It concludes with an alphabetical index.

New South Wales—Barrier Ranges. **Jaquet.**

Department of Mines and Agriculture. Memoirs of the Geological Survey of New South Wales. Geology, No. 5. Geology of the Broken Hill Lode and Barrier Ranges Mineral Field, New South Wales, with Maps, Plates, and Sections. By J. B. Jaquet. Sydney, C. Potter, 1894. Size 12 × 10, pp. ix. and 149. *Maps, Sections, and Plates.*

Chapter II. of this Memoir deals with the Physical Geography and Meteorology of the district described.

New South Wales—Irrigation. **McKinney.**

J. & P.R.S. New South Wales **27** (1893): 384-400.

The Progress and Position of Irrigation in New South Wales. By H. G. McKinney.

POLAR REGIONS.

Spitzbergen, etc. **Bienaimé and others.**

Nouvelles Archives Missions Scientifiques **5** (1893): 1-264.

Voyage de "la Manche" à l'Ile Jan-Mayen et au Spitzberg (Juillet-Août, 1892).

Captain Bienaimé, who was in command of the expedition, contributes a narrative of the voyage, M. R. de Carfort summarizes the hydrographical work and discusses the tides, glacier observations, and meteorology. Magnetic and gravity observations are described by other members of the expedition, and the zoological, botanical, and geological collections are described by specialists. There are numerous maps and a set of finely reproduced photographs.

Spitzbergen, etc. *B.S.G. Paris* **15** (1894): 5-69. **Rabot.**

Explorations dans l'Ocean Glacial Arctique. Islande—Jan Mayen—Spitzberg, par M. Charles Rabot.

M. Rabot here gives a detailed account of his two summer cruises in high latitudes, undertaken in 1891 and 1892.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Agronomic Maps. *C.R.* **118** (1894): 1167-1170. **Gatellier.**

Carte agronomique du canton de la Ferté-sous-Jouarre. Note de M. Gatellier.

Agronomic maps are intended to supply detailed practical information regarding the suitability of soil for agricultural purposes. They are based on large-scale geological maps, and have additional information placed on them regarding the mechanical and chemical composition of the soil to serve as a guide to farmers for the proper fertilizers to apply to the land. This additional information is obtained by a large number of analyses of samples carefully selected. The sheets of the communes already prepared show, as might be expected, an intimate relation between the character of the soil and that of the underlying rocks.

Biological Distribution. *Report Smithsonian I.* **1891** (1893): 365-415. **Merriam.**

The Geographic Distribution of Life in North America. With special reference to the mammalia. By C. Hart Merriam, M.D.

This is reprinted from the *Proceedings* of the Biological Society of Washington, vol. 7.

Continental origins. *J. of Geol.* **2** (1894): 383-395. **Upham.**

Wave-like progress of an Epeirogenic Uplift. By Warren Upham.

The word *epeirogenic* was introduced by Gilbert to signify the broad movements of uplift or sinking which affect a whole continent, as distinguished from the sharper orogenic movements which produce mountain ranges. A study of the evidences for uplift in North America since the last Ice-age leads Mr. Upham to conclude that it was "an effort of the Earth to regain a state of isostasy, or flotation of the crust on the heavier mobile interior, which is capable of flow, whether it be solid or molten."

Elevation of Land. **Sieger.**

Seenschwankungen und Strandverschiebungen in Skandinavien von Dr. Robert Sieger, in Wien. Mit einer Tafel und 28 Zifferntabellen. Sonderabdruck aus der Zeitschrift der Gesellschaft für Erdkunde zu Berlin, xxviii. Band, 1893, No. 1 und 6. Berlin, 1893. Size 9 × 6, pp. 202. *Presented by the Author.*

This work was noticed in the *Journal*, vol. ii. p. 262.

Figure of the Earth. *Report Smithsonian I.* **1891** (1893): 127–153. **Chree.**

Some Applications of Physics and Mathematics to Geology. By C. Chree.

As geographers we are grateful to the Smithsonian Institution for culling from various sources and reprinting in an accessible form such papers as this of Mr. Chree's, the permanent value of which may be taken as well established. It originally appeared in the *Philosophical Magazine* for 1891, vol. 32, p. 233.

Forest Growth. *National G. Mag.* **6** (1894): 127–148. **Fernow.**

The Battle of the Forest. By B. E. Fernow.

A plea for forest culture concluding, "While man may *study* the geography of the Earth as it exists, here is about the only opportunity for him to *make* geography, to shape the surface conditions of the Earth, and even to some extent influence its climatic conditions."

Geodesy. **Hirsch.**

Comptes-Rendus des Séances de la Commission Permanente de l'Association Géodésique internationale, réunie a Genève du 12 au 18 Septembre, 1893. Rédigés par le Secrétaire perpétuel A. Hirsch. Suivis des Rapports sur les travaux géodésiques accomplis dans les différents pays pendant la dernière année. Avec 21 cartes et planches. Berlin, Georg. Reimer, 1894. Size 11½ × 9, pp. 194.

Geodesy. *Rev. G. Italiana* **1** (1894): 293–305. **Viezzoli.**

Gli odierni studii sulla figura della Terra, del Prof. Francesco Viezzoli.

A compilation stating the steps which have led to the modern views of the figure of the Earth.

Geodesy. **Rosén.**

Projet de Mesure d'un Arc du Méridien de 4° 20′ au Spitzberg, par P.-G. Rosén. Stockholm, P. A. Norstedt & Sons, 1893. Size 10 × 7, pp. 31. *Map. Presented by the Author.*

The proposition to measure a long arc of the meridian nearer the pole than has ever previously been attempted is one that should be warmly received by all geographers, on account of its important bearing on the exact figure of the Earth. M. Rosen shows that the scheme is perfectly practicable.

Geology. *J. Manchester G.S.* (1892): 226–230. **Dawkins.**

Geology in Relation to Geography. By Professor W. Boyd Dawkins.

Glacial Cañons. *J. of Geol.* **2** (1894): 350–364. **McGee.**

Glacial Cañons. By J. W. McGee.

A theoretical paper on the excavatory power of ice, founded on practical observations in the Sierra Nevada. The conclusion arrived at is that the invasion of a water-cut cañon by ice would suffice to alter all the characteristic features into those of glacial origin. "It follows that these features do not necessarily imply extensive glacial excavation, or indicate that glaciers are superlatively energetic engines of erosion."

Gulf Stream. *Report Smithsonian I.* **1891** (1893): 189–206. **Agassiz.**

The Gulf Stream. By Alexander Agassiz.

This is reprinted from the *Bulletin* of the Museum of Comparative Zoology at Harvard College, vol. 14, chap. 9. It is illustrated by historical and other maps and by diagrams.

Land-forms. *Rev. G. Italiana* 1 (1894): 33–51. **Borzino.**

La Linea di Displuvio. Contributo allo studio della Geografia Fisica. Ten. Colonn. C. Borzino.

A treatise on the form of land-surfaces, with special reference to the slopes of mountain and valley sides as determined by rain-washed material.

Mathematical and Physical Geography. **Klein.**

Jahrbuch der Astronomie und Geophysik. Enthaltend die wichtigsten Fortschritte auf den Gebieten der Astrophysik, Meteorologie und physikalischen Erdkunde. Herausgegeben von Dr. Hermann J. Klein. IV. Jahrgang, 1893. Leipzig, E. H. Mayer, 1894. Size 9 × 6, pp. viii. and 360. *Plates. Price 7s.*

This contains good summaries of many of the more important memoirs published in 1893.

Meteorology. **Bezold.**

Deutsches Meteorologisches Jahrbuch für 1890. Ergebnisse der Meteorologischen Beobachtungen im Jahre, 1890. Herausgegeben von dem königlich Preussischen Meteorologischen Institut durch Wilhelm von Bezold, Direktor. Heft III. Berlin, A. Asher & Co., 1893. Size 13 × 10. *Map, etc.*

Oceanography. *Scottish G. Mag.* 10 (1894): 281–302, 352–359, 413–427. **Pettersson.**

A Review of Swedish Hydrographic Research in the Baltic and the North Seas. By Otto Pettersson. *With Plates.*

The first three instalments of this magnificent memoir deal with the methods by which the investigation is being carried on, and with the resulting discovery of the extent and movement of the Baltic Current in the Skagerak and North Sea, with the thermal conditions of the water at different periods and the meteorological results.

Oceanography—Baltic. **Krümmel.**

Neue physikalische Untersuchungen aus der Ostsee. Von Professor Dr. O. Krümmel. Sonder-Abdruck aus den "Mittheilungen der Sektion für Küsten- und Hochsee-Fischerei." Nr. 6. Juni, 1894. Size 10 × 6½, pp. 10. *Presented by the Author.*

A popular paper on recent oceanographical work in the Baltic and eastern part of the North Sea.

NEW MAPS.

By J. Coles, *Map Curator*, R.G.S.

EUROPE.

British Isles. **Inglis.**

The "Exeter Road" Map, London to Salisbury and Exeter. Compiled by H. R. H. Inglis. Half an inch to a stat. mile. *Price* 1*s.*

The Land's End to John o' Groats Map—Land's End to Worcester and Birmingham. 2 parts. Compiled by H. R. H. Inglis. Half an inch to a stat. mile. *Price* 2*s.* each part.

"The Safety" Cycling Map of Scotland. Edited by H. R. H. Inglis. 10 stat. miles to an inch. Gall and Inglis, London. *Presented by the Publishers.*

England and Wales. **Ordnance Survey.**

Publications issued since July 8, 1894.

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ENGLAND AND WALES:—Sheets 177, 214, engraved in outline; 327, hills photozincographed in brown; 315, 316, 334, hills engraved in black or brown. 1*s.* each.

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Town Plans—5-feet scale:—

London (Revision), with houses stippled, II. 30, 40, 87, 97; III. 13, 23; VI. 7, 17, 27, 37, 72, 73, 74, 75, 82, 83, 84, 85, 92, 93, 94; IX. 49, 50, 59, 69, 78, 79, 87, 88, 89, 97, 98; X. 2, 3, 4, 13, 23, 2*s.* 6*d.* each; XIII. 6, 7, 8, 16, 17, 18, 19, 28, 2*s.* 6*d.* each. Index, 3*d.*

——— 10-feet scale:—

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Middlesborough (Yorkshire), VI. **10**, 1; VI. **11**, 11, 16, 19, 20, 21, 22, 23, 24, 25; VI. **12**, 16, 17, 20, 21, 22, 24, 25; VI. **14**, 7; VI. **15**, 1, 2, 3, 4, 5, 6, 7, 11, 12; VI. **16**, 1, 2, 5. This town is now complete in 73 sheets, 2*s.* 6*d.* each. Index, 6*d.*

Plymouth and Environs (Revision), CXXIII. 7, 19; CXXIII. **11**, 8, 10, 5; CXXIII. **12**, 6, 10, 13, with houses stippled.

(*E. Stanford, Agent.*)

Harrogate. **Bartholomew.**

Plan of Harrogate, with Environs. By J. Bartholomew, F.R.G.S. London, W. H. Smith & Son. *Price* 2*s.*, *mounted on cloth*, 1894. *Presented by the Author.*

This map consists of two parts on one sheet. The first is a plan of Harrogate, drawn on the scale of eight inches to the mile; and the second is a reduction of the Ordnance Survey, to the scale of four miles to an inch, of the environs of Harrogate.

Scotland. **Bartholomew.**

Bartholomew's Reduced Ordnance Survey for Tourists and Cyclists. Scale 1: 126,720 or 2 stat. miles to an inch. Sheet 5. Hawick and Borders. J. Bartholomew & Co., Edinburgh. *Price* 2*s.*, *mounted on cloth. Presented by the Publishers.*

This map belongs to Bartholomew's reduced Ordnance Survey series. The relief is shown by a combination of orographic colouring and contouring, the heights above sea-level being also given in figures. All means of communication are laid down, main driving roads being coloured brown; footpaths and bridle-paths are indicated. The clear style in which this map is drawn, and the large amount of information it contains, combine to make it peculiarly suitable for the use of tourists and pedestrians.

ASIA.

China, Japan, and Korea. **Bartholomew.**

Bartholomew's Special War Map of China, Japan, and Korea. Scale 1: 6,000,000 or 94·6 stat. miles to an inch. With Insets. J. Bartholomew & Co., Edinburgh, 1894. *Presented by the Publishers.*

At the present time, when public attention is directed to the Far East, in consequence of the war between China and Japan, there will no doubt be a considerable demand

for a cheap map which can be used for reference in connection with the newspaper reports of the movements of the land and sea forces of the contending nations, and it is to meet this want that the map under notice has been published. It contains the eastern portion of the Chinese Empire, Korea, Japan, and the southern portion of the Russian territory bordering on Manchuria, and Korea. A very nice little map of Asia is given as an inset, as are also plans of the mouth of the Canton river, Hong-Kong, Shanghai, Pekin, and Tokio Bay.

China, Korea, and Japan. **Philip.**

Special War Map of China, Korea, and Japan. Compiled from the most recent and authentic sources. Scale 1 : 4,380,000 or 69·1 stat. miles to an inch. George Philip & Son, London & Liverpool. *Price* 1*s.*

AFRICA.

Sahara. **Vuillot.**

Carte du Sahara et du Nord-Ouest de l'Afrique de la Méditerranée au Sénégal et au Lac Tchad. Dressée par P. Vuillot. Scale : 1 : 4,000,000 or 63·6 stat. miles to an inch. A. Challamel, Paris. *Price 5 francs.*

All the most recent and reliable material has been used in the compilation of this map. The hill shading is in brown, water blue, and the caravan routes, wells, etc., are clearly indicated.

ARCTIC REGION.

Greenland. **Peary.**

Carta Speciale delle Regioni Artiche tra il Canale di Smith, il Mare di Lincoln e la Baia Independence; specialmente secondo i rilievi eseguiti dalle Spedizioni Polari dirette da C. F. Hall, 1871–72; G. S. Nares, 1875–76; A. W. Greely, 1881–84; R. E. Peary, 1891–92. Redatta in base alle Carte Idrografiche Americane ed Inglesi ed a numerosi altri documenti dal Prof. Guido Cora. Scale 1 : 1,525,000 or 24·6 stat. miles to an inch. Estratto dal Cosmos di Guido Cora. Serie II. Volume XI. (Torino, 1892–93). Fascicolo XII. Torino: Fratelli Bocca, 1894.

The results of Peary's explorations in the north of Greenland are laid down on this map, in the compilation of which the charts of the British and American Hydrographic Offices have been used. It is nicely drawn, and is accompanied by letterpress.

PHOTOGRAPHS.

Beira Railway. **Britton.**

44 photographs of the Beira Railway, taken by A. C. Britton, Esq. *Presented by J. Batalha-Reis, Esq.*

This is a series of views taken at different positions on the Beira railway. They convey a very good idea of the country through which the line passes, and manner in which the railway has been constructed.

Sikkim and Nepal. **Johnston and Hoffmann.**

93 photographs of Sikkim and Nepal, by Messrs. Johnston and Hoffmann, of Calcutta and Darjiling. *Presented by Messrs. Johnston and Hoffmann.*

This is a further contribution to the valuable series of photographs which have been presented to the Society by Messrs. Johnston and Hoffmann, of Calcutta and Darjiling. In the present donation there are 19 photographs of scenery in Nepal which are of special value, as there are no others of this country in the Society's collection. All of the views are well chosen, and they are beautiful specimens of photography.

Swaziland and Tongaland. **Allan.**

45 photographs of Natives and Scenery in Swaziland and Tongaland, taken by George Allan, Esq., J.P. *Presented by George Allan, Esq., J.P.*

These interesting photographs have been taken by Mr. Geo. Allan, during the past two years, while travelling in Swaziland and Tongaland. They include types of natives, kraals, and scenery, and are good specimens of photography.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

36°
1°
0°
Subugu
Loluko
Weweini
Wei Wei
Amaya
Opolok
Morongop
Telek
Lare lol borngi
Erri Mt.
Mogodeni
L.
Baringo
3200
Lersubugo
Doenyo Gelesha
KAMASIA
Longorovo
Susien
Mio Samaki
Scrub & grass
Ndoa
Kamnyi
Lit. Njemps
Njemps
Kachurin
Lugave
Kamasia Scarp
Eldoma
Maji Moto
Lorumbwa
D. Nelesha
D. Lugumut
Lorguna
Gopotol Mwaru
Alnggria
Lari la Mbiryo
Scrub
Open grass
Nekiete
Eldoma Sta.
Kesokon
L. Kibibi
Swampy
Equator
Eldalat
Elgwarigon
Londiani
Laikipia Escarpment
Subugu
Wooded
Moto
Lala Surai
Moio Sta.
Mwiruruna
Menengai
6800
NAKURO
Bare
Rangata Busi
Swampy
El Burgon Range
Open grass
Lakari
L. Lesigria
Mbaruki
Nakuro (Salt)
8880
C. Subugo
Kikopa
K. Mezo
Armoshi
L. Elmenaritoo (Salt)
Flat Top
Elmenteita Sta.
Goelil
Extinct Craters
Rangata yanoki
Mau Escarpment
Setima Fault
D. Buru
Steam Vents
8700
Murcadati
Kinan Kinangop
Naivasha Sc.
Kiambu plain
L. Naivasha 6250
Lorien
MAU
6800
Longonot
(Extinct volcano) (Bare)
8700
Andorobbo
C. Na Erok
7400
Lava Flow
Lagormot
D. Nyuki
Saiorotoro (Rift Valley)
Karumuto
Uninhabited
Forest and grass
Suswa
(Extinct Volcano) (Bare)
Endumeta
Elelesha
Mgur
Mosiro
Dogilan
Pasture lands
C. Kedong
Guaso Nyiro
Soaian
Loroidok
Logobiti
Samiten
BARINGO
Lost Diris
Langari
Mandaladu
Laikrum
Lagumbro
G. Dyke
G. Poli
G. Ndoa
Njemps
Old Lake Bed
Swamp
1:500,000
10 Miles
A MAP
illustrating a Journ
MOUNT K
AND
LAKE BARI
By DR. J. W. GREGO
Scale—1 : 1,000,00
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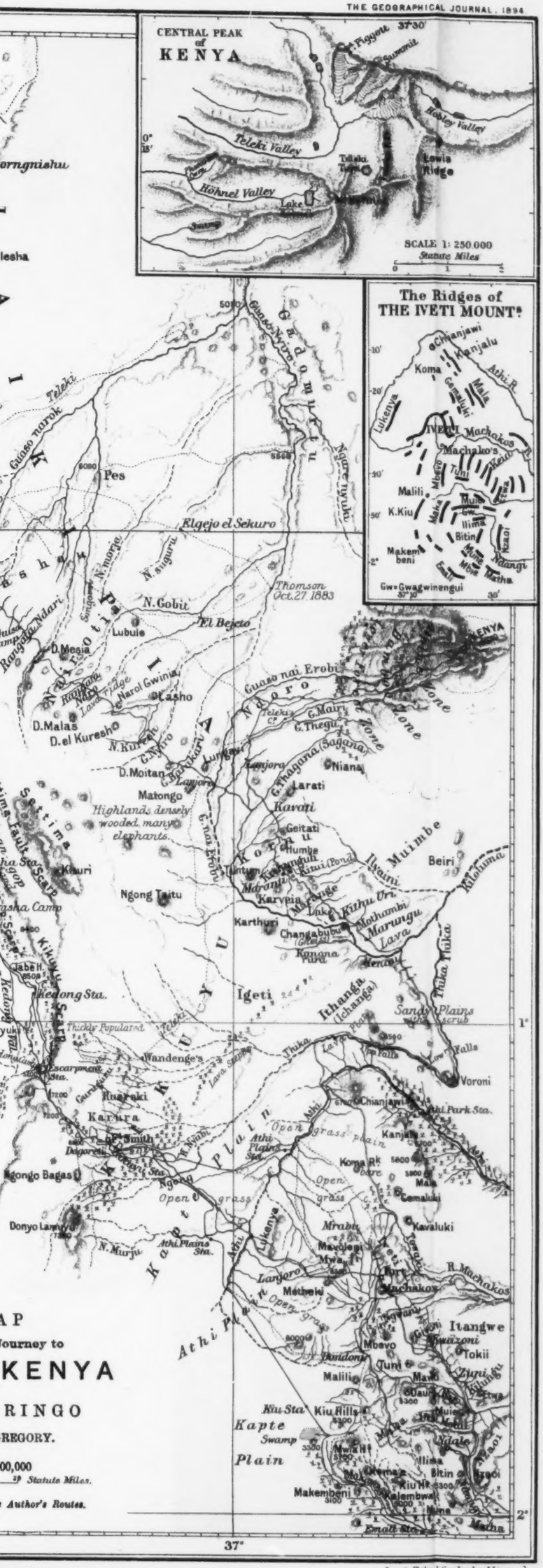
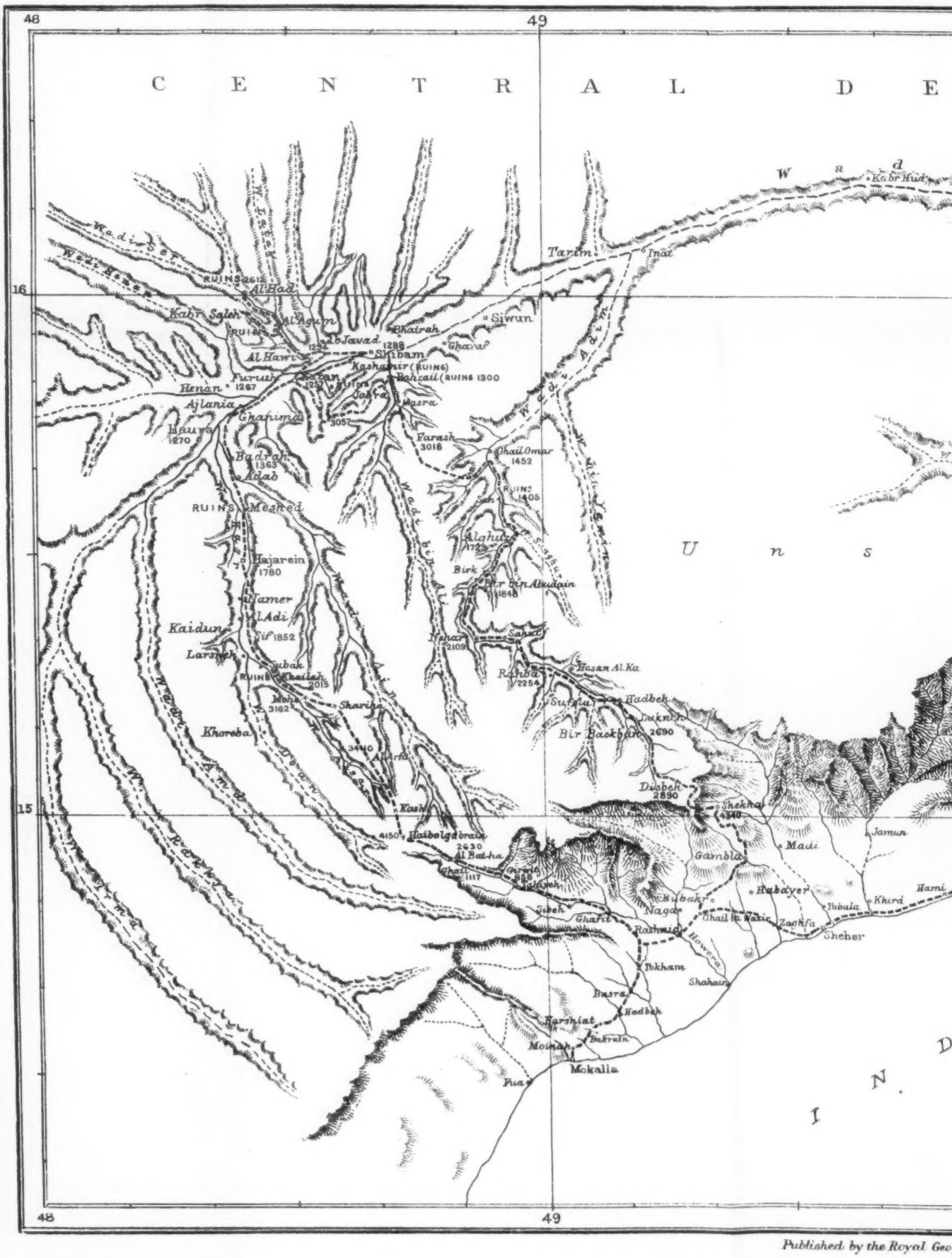
Published by the


CENTRAL PEAK of KENYA
Figgore
Summit
Hobley Valley
Teleki Valley
Lewis Ridge
Höhnel Valley
Lake
SCALE 1: 250.000
Statute Miles
The Ridges of THE IVETI MOUNTS
Chianjawi
Kanjalu
Koma
Athi R.
Machakos
Machako's
Malili
Mbooni
K.Kiu
Mulu
Ilima
Bitin
Makembeni
Gw=Gwagwinengui
Pes
Elgejo el Sekuro
N. Gobit
El Bejeto
Thomson Oct. 27. 1883
D.Mesia
Lubuie
D.Malas
D.el Kuresho
Narol Gwinia
Lasho
Guaso nai Erobi
G.Mairu
G.Thegu
Nyiro Zone
Ndoro Zone
KENYA
Matongo
Highlands densely wooded, many elephants.
Larati
Kavati
Geitati
Kikuyu
Beiri
Muimbe
Ngong Taitu
Karthuri
Changabubu
Kenia
Igeti
Ithanga (Ichanga)
Sandy Plains with scrub
Thickly Populated
Wandenge's
Escarpment Sta.
Voroni
Athi Park Sta.
Kanjalu
Kamalaki
Kavaluki
Mrabu
Machakos
R. Machakos
Itangwe
Tokii
Mbovo
Malili
Kiu Sta.
Kiu Hills
Kapte Swamp
Plain
Ilima
Bitin
Kiu Hr.
Kalembwai
Makembeni
Mutha
Emali Sta.
Athi Plains
Open grass plain
Donyo Lamwigi
N. Murju
Ngongo Bagas
Kaputei Plains
Athi Plains Sta.
Kiu Sta.
Kibwezi
Kikumbulyu
Kedong Sta.
Escarpment Sta.
Rhuraki
Kaputei
Smith
Jabe H.
Septima Fault Scarp
Khuri
Ngong Camp
Donyo Sabuk
Thika
Sandy Plains with scrub
Falls



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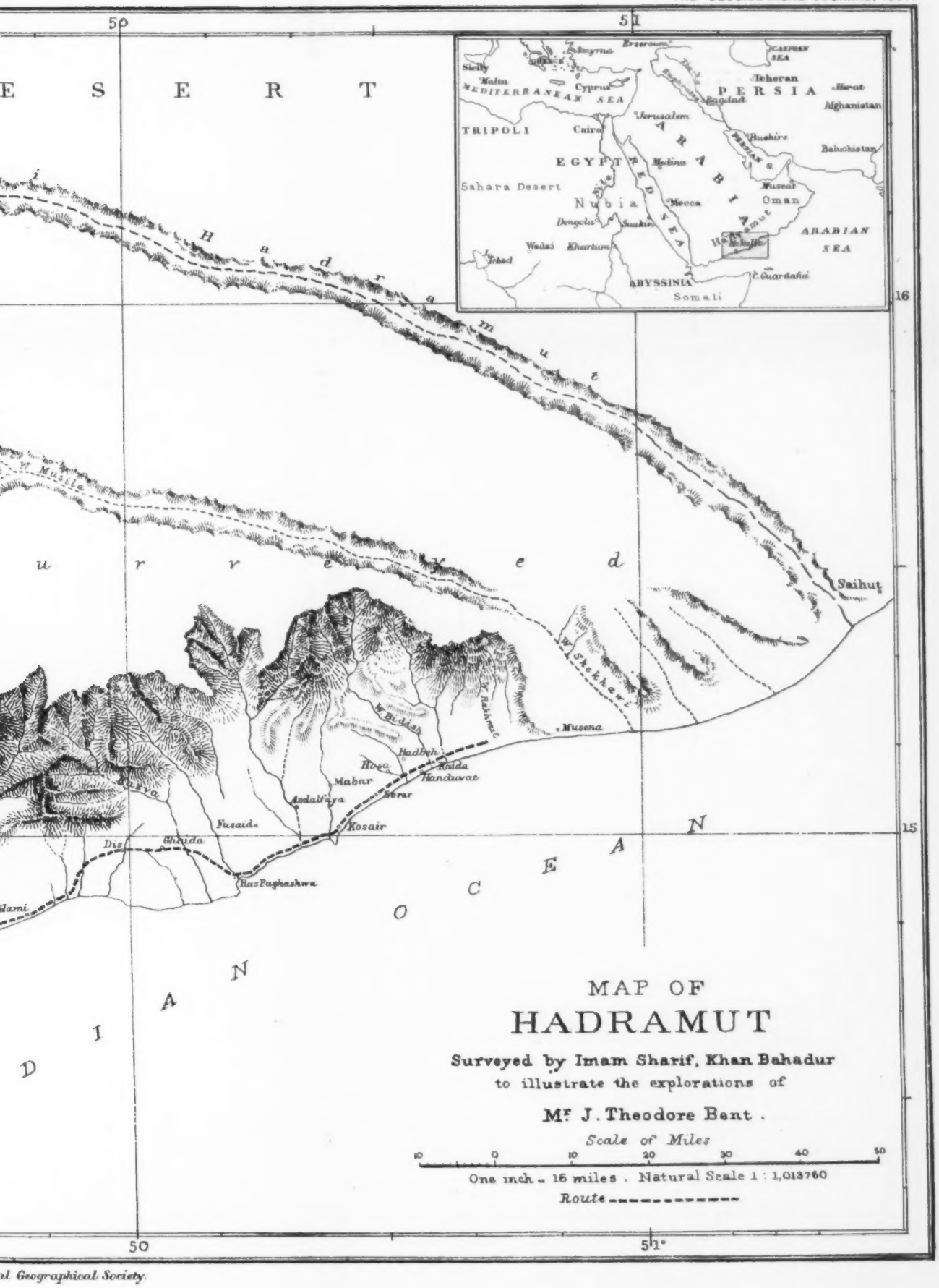

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